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# EVANSIA

Volume 18 Number 1

**Mosses of New Mexico – County Checklist**
Carl E. Darigo & Kelly W. Allred 1

**Long-Term Storage of TLC Data**
Robert S. Egan 19

**Eagle Hill Field Seminars, 2001** 20

**A New Inland Site in New York State for *Sphagnum angermanicum***
Thomas Phillips and Norton G. Miller 21

**The genus *Bruchia* (Musci: Bruchiaceae) in Maine**
Bruce Allen 23

**The Liverwort Flora of Antarctica** 26

**Bryophyte Records for Arkansas**
Piers Majestyk 27

**Other titles from the IB Publisher, Polish Academy of Sciences** 30

**Gemmae on Leaves and Other Observations Regarding *Bryum flaccidum* Brid.**
Virgil Martin 31

**The American Bryological and Lichenological Society 2001 meeting** 40

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# Mosses of New Mexico – County Checklist

**Carl E. Darigo[1] & Kelly W. Allred[2]**

GEOGRAPHY. New Mexico is a "square-shaped" state of almost 122,000 square miles located in the southwestern United States, bordered on the west by Arizona, on the north by Colorado, on the east by Texas and a small portion of the Oklahoma panhandle, and on the south by Texas and Mexico. Generally, the state could be described as a rolling plain, sprinkled with isolated mountain ranges, having elevations ranging from about 2,800 to over 13,000 feet. The state has four distinct regions: Great Plains in the east, Rocky Mountains north-central, Colorado Plateau northwestern, and Basin and Range south-central and southwest. The high Great Plains come in from the east and rise gradually, breaking into low plateaus west of the Pecos River, which blend into the mountain ranges lying east of the Rio Grande River. The Sangre de Cristo range is northernmost, forming the southern end of the Rocky Mountains, where the state's highest point, 13,161-foot Wheeler Peak, is located. Mesa country begins west of the Rio Grande, leading to two major mountain masses, the San Juans in the north, and San Mateo, Black and Mogollon ranges in the west-central section of the state. Located in the south bordering the Basin and Range Region are the San Andres, Organ, Sacramento and Guadalupe mountain ranges. Four main river systems occur, the San Juan in northwest, Canadian in northeast, Pecos in east and the Rio Grande dividing the state centrally north to south. The Continental Divide passes through the west side of the state and Carlsbad Caverns National Park is located in the far southeast corner. New Mexico is very dry, with rainfall averaging less than 20 inches annually, varying from less than 10 inches in the south and center, to more than 25 inches in the northern higher elevations.

BACKGROUND. The last checklist of New Mexico mosses was published by Mahler (1978), based on literature sources for the period 1924-1973. Since then, 14 (see Table 1) publications have placed additional records in the New Mexico flora. This paper combines all literature records on New Mexico mosses with the addition of material examined at MO, NMC and NMCR, plus several collections from other herbaria (FH, NY, PC, UTEP). Many of the MO collections came from the late Gilford J. Ikenberry, a botany

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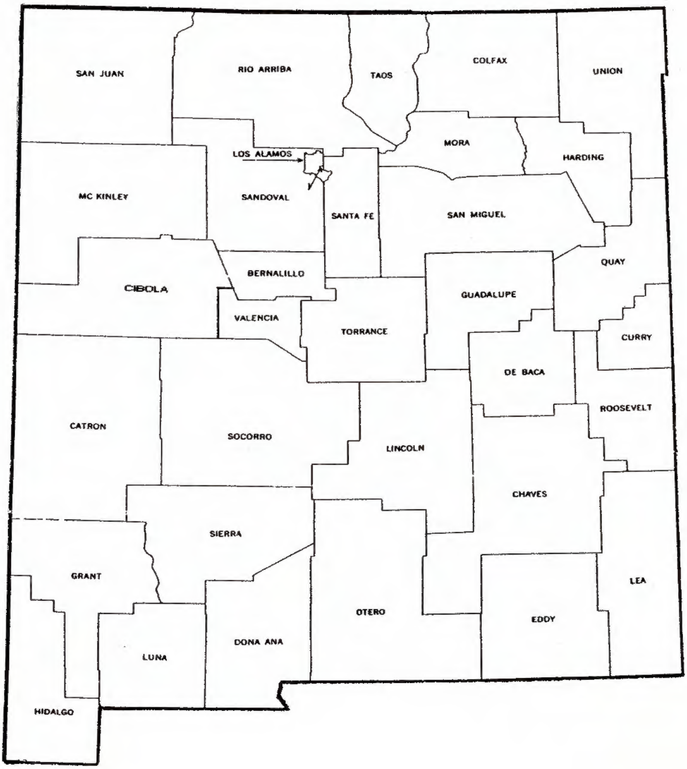
professor who taught at several New Mexico and Oklahoma colleges, and collected extensively in New Mexico from the 1930s to 1950s. Collections received from Janice Glime are also included in MO data. Determinations were verified by the authors and confirmed by Bruce Allen or William Weber, as needed.

CHECKLIST DESCRIPTION. The following checklist documents the occurrence of New Mexico mosses at the county level. Taxa are listed alphabetically by family, by genus and by species. Each county is denoted by a two-letter abbreviation, as follow:

> BE-Bernallilo, CA-Catron, CH-Chaves, CI-Cibola, CO-Colfax, DA-Dona Ana, ED-Eddy, GR-Grant, GU-Guadalupe, HA-Harding, HI-Hidalgo, LI-Lincoln, LU-Luna, MK-McKinley, MR-Mora, OT-Otero, QU-Quay, RA-Rio Arriba, RO-Roosevelt, SJ-San Juan, SM-San Miguel, SA-Sandoval, SF-Santa Fe, SI-Sierra, SO-Socorro, TA-Taos, TO-Torrance, UN-Union, VA-Valencia.



New Mexico

The occurrence of a taxon within a county is documented in either of two ways:

1. Taxon names and/or counties followed by identifying numbers are from publications as shown in "Key to Distributional Information", Table 1.
2. Counties with collections cited are new county records and show collector's name, collection number (if available) and herbarium designation.

SUMMARY. The checklist contains 36 families, 119 genera, and 291 species and varieties. Species and varieties reported by county are:

| | | | | | |
|---|---|---|---|---|---|
| Dona Ana | 135 | Colfax | 32 | Union | 12 |
| San Miguel | 122 | Bernallilo | 31 | Cibola | 10 |
| Taos | 91 | Hidalgo | 28 | Quay | 9 |
| Santa Fe | 79 | Torrance | 28 | McKinley | 8 |
| Lincoln | 75 | Luna | 26 | Guadalupe | 7 |
| Grant | 52 | Sierra | 25 | Chaves | 3 |
| Otero | 52 | Eddy | 22 | Roosevelt | 2 |
| Mora | 50 | Socorro | 22 | San Juan | 2 |
| Sandoval | 45 | Rio Arriba | 17 | Valencia | 2 |
| Catron | 35 | Harding | 13 | | |

Four counties (Curry, De Baca, Lea, Los Alamos) had no reports; 17 taxa had no county identified.The following eight taxa (identified by an asterisk in the checklist), are reported new to New Mexico:

*Bryum incrassatolimbatum* Card.
*Ceratodon stenocarpus* Bruch & Schimp. *in* B.S.G.
*Fissidens bryoides* Hedw. var. *viridulus* (Sw.) Broth.
*Funaria calvescens* Schwaegr.
*Grimmia elatior* Bruch *ex* Bals.-Criv. & De Not.
*Grimmia montana* Bruch & Schimp. *in* B.S.G.
*Grimmia ungeri* Jur.
*Hygroamblystegium noterophilum* (Sull. & Lesq. *in* Sull.) Warnst.

## COUNTY CHECKLIST

AMBLYSTEGIACEAE

***Amblystegium***

***serpens*** (Hedw.) Schimp. *in* B.S.G. var. ***serpens*** BE-Ikenberry (MO), CA-Allred 6541 (NMCR), CO-Standley 13772A (MO), DA(15), GR-Allred 7193.1 (NMCR), SM(12), SA-Allred 6526 (NMCR), SF(12), TA-Ikenberry

***serpens*** (Hedw.) Schimp. *in* B.S.G. var. ***juratzkanum*** (Schimp.) Rau & Herv. SM(12), SA(12), SF(12), SI-Barnett A20 (NMCR), TA-Ikenberry 628 (MO)

**varium** (Hedw.) Lindb. DA(15), SM-Allred 6381 (MO), SA(12)

***Calliergon***

**stramineum** (Brid.) Kindb. no county given (15)

***Campylium***

**chrysophyllum** (Brid.) J. Lange DA(15), HI-Harvill 2815 (MO), LI-Ikenberry (MO), OT-Ikenberry (MO), SM(12), SF(12), TA-Waller (MO)

**hispidulum** (Brid.) Mitt. DA(16), SM(12), UN-Pursell 2960 (MO)

**radicale** (P. Beauv.) Grout TA(13)

**stellatum** (Hedw.) C. Jens. var. **stellatum** no county given (13) TA-Ikenberry (MO)

***Conardia***

**compacta** (C. Müll.) Robins. DA-Allred 7351 (NMCR), ED(5), SA-Glime 1431B (MO), TO-Ikenberry (MO)

***Cratoneuron***

**filicinum** (Hedw.) Spruce BE-Ikenberry 662G (MO), CA-Crutchfield & Campbell 135A (MO), CO-Darigo & Darigo 2989 (MO), GR-Zimmerman 2836A (MO), LI-Allred 6731 (NMCR), OT-Allred 7374 (NMCR), SM(12), SA(12), SF(12), TA-Ikenberry (MO)

***Drepanocladus***

**aduncus** (Hedw.) Warnst. var. **aduncus** CA-Allred 6558 (NMCR), MR-Allred 6842 (NMCR), OT-Allred 7373 (NMCR), RA-Bleakly 2891 (NMCR), SM(12)

**aduncus** (Hedw.) Warnst. var. **kneiffii** (Schimp. *in* B.S.G.) Mönk. no county given (13)

**aduncus** (Hedw.) Warnst. var. **polycarpus** (Bland. *ex* Voit) G. Roth no county given (13), LI-Allred 7389 (NMCR), OT-Allred 7388 (NMCR)

**sendtneri** (Schimp.) Warnst. SM(12)

***Hygroamblystegium***

**fluviatile** (Hedw.) Loeske SM(12), TA-Kenney & Fornwall (MO)

*__noterophilum__ (Sull. & Lesq. *in* Sull.) Warnst. TA-Kenney & Fornwall (MO)

**tenax** (Hedw.) Jenn. var. **tenax** CA-Allred 6574 (NMCR), DA(15), GR-Crowell (MO), LI-Ikenberry (MO), SM(12), SA-Glime 1428 (MO), SF-Ikenberry (MO), SI-Barnett 16 (NMCR)

***Hygrohypnum***

**luridum** (Hedw.) Jenn. BE-Ikenberry 662C (MO), DA(15), LI-Ikenberry (MO), SM(12), TA-Ikenberry 617 (MO)

**molle** (Hedw.) Loeske SF(12)

**ochraceum** (Turn. *ex* Wils.) Loeske LI-Allred 7111 (NMCR), MR(13), SM-Allred 6396 (NMCR)

***Leptodictyum***

**humile** (P. Beauv.) Ochyra CA-Allred 6588 (NMCR), DA(10), SM-Allred 6356 (MO), TO-Ikenberry (MO)

**riparium** (Hedw.) Warnst. CA-Adams 210 (NMCR), DA(15), GR-Harvill 2801 (MO), LI(15), MR-Allred 6841 (NMCR), SA(7), TA(7)

***Palustriella***

**commutata** (Brid.) Ochyra MR(1), OT-Allred 7380 (NMCR), TA(1)

**decipiens** (De Not.) Ochyra TA(1)

***Sanionia***

***uncinata*** (Hedw.) Loeske var. ***uncinata*** OT-Sivinski 4502 (NMCR), SM-Voth 15961 (MO), SF(12), SO-Kearns 1 (MO), TA-Ikenberry (MO)

ANDREAEACEAE

***Andreaea***

***rupestris*** Hedw. TA(13)

ANOMODONTACEAE

***Anomodon***

***attenuatus*** (Hedw.) Hüb. DA(15), GR-Crowell (MO), LI-Ikenberry (MO), SM(12), SF(12), SI-Worthington 25036 (MO)

***minor*** (Hedw.) Fürnr. GR(10), LI-Ikenberry (MO)

***rostratus*** (Hedw.) Schimp. DA(15), GR-Harvill 2792 (MO), SM(12)

AULACOMNIACEAE

***Aulacomnium***

***palustre*** (Hedw.) Schwaegr. no county given (12), SF(2), TA-Ikenberry (MO)

BARTRAMIACEAE

***Anacolia***

***laevisphaera*** (Tayl.) Flow. DA(15), SM(12)

***Bartramia***

***brevifolia*** Brid. TA(6)

***ithyphylla*** Brid. SM(12)

***potosica*** Mont. SM(6)

***Philonotis***

***capillaris*** Lindb. *in* Hartm. no county given (12)

***fontana*** (Hedw.) Brid. var. ***fontana*** CA-Allred 6540 (NMCR), DA(15), GR-Allred 7184.2 (NMCR), HI-Worthington 26585 (NMCR), MR-Allred 6839 (NMCR), RA-Bleakly 2889 (NMCR), SM(12), SF(12), TA-Ikenberry (MO)

***fontana*** (Hedw.) Brid. var. ***americana*** (Dism.) Flow. no county given (15), CA-Adams (NMCR)

***fontana*** (Hedw.) Brid. var. ***caespitosa*** (Jur.) Schimp. DA(15)

***fontana*** (Hedw.) Brid. var. ***pumila*** (Turn.) Brid. SM(12), SF(12)

***marchica*** (Hedw.) Brid. SM(12)

BRACHYTHECIACEAE

***Brachythecium***

***acuminatum*** (Hedw.) Aust. var. ***acuminatum*** LI-Ogle (MO), SM(12), TO-Ikenberry (MO)

***acutum*** (Mitt.) Sull. SM(12)

***albicans*** (Hedw.) Schimp. *in* B.S.G. DA(15)

***collinum*** (Schleich. *ex* C. Müll.) Schimp. *in* B.S.G. CI-Allred 6534 (NMCR), CO-Glime 1421C (MO), DA(12), HA-Pursell 2975 (MO), LI-Allred 6799 (NMCR), LU-Crowell (MO), MR-Pursell 2999 (MO), OT-Ikenberry (MO), RA-Standley 6768 (MO), SM(12), SA(12), SF-Ogle (MO), TA-Ikenberry (MO), UN-Pursell 2958 (MO)

***erythrorrhizon*** Schimp. *in* B.S.G. LI-Allred 6452 (NMCR), RA-Ballman (MO), SF(12), TA-Ikenberry 359 (MO)

***fendleri*** (Sull.) Jaeg. DA(15), OT-Wooten 3753 (NMC), SM(12), SF(12), SI-Allred 7031 (NMCR)

***nelsonii*** Grout MR(1)

***oedipodium*** (Mitt.) Jaeg. LI(1)

***plumosum*** (Hedw.) Schimp. *in* B.S.G. MO(13), TA(13)

***populeum*** (Hedw.) Schimp. *in* B.S.G. SF(12)

***rivulare*** Schimp. *in* B.S.G. CO-Standley 13772 (MO), DA(15), MR-Standley 3998 (NMCR), SM(12), SF(12), TA-Ikenberry (MO)

***salebrosum*** (Web. & Mohr) Schimp. *in* B.S.G. var. ***salebrosum*** BE-Ikenberry (MO), GR-Metcafe (MO), HI-Todson 90-3 (MO), OT-Ikenberry 622 (MO), SA-Glime 1432 (MO), SM-Weber B44682 (MO), TA(13)

***stereopoma*** (Spruce *ex* Mitt.) Jaeg. CI-Ivey 203 (NMCR), DA(15), LI(12), OT-Allred 7005 (NMCR), SF-Allred 6348 (MO)

***velutinum*** (Hedw.) Schimp. *in* B.S.G. var. ***velutinum*** MR-Allred 6919 (NMCR), SM(12)

***velutinum*** (Hedw.) Schimp. *in* B.S.G. var. ***venustum*** (De Not.) Arc. DA-Stark & Casteter 2368 (MO), OT-Ikenberry (MO), SM(12), SO-Kearns 6 (MO), TA-Ikenberry (MO), TO-Ikenberry (MO)

***Eurhynchium***

***pulchellum*** (Hedw.) Jenn. var. ***pulchellum*** CO-Standley (MO), DA(15), GR-Harvill 2805 (MO), HI-Harvill 2815 (MO), SM(12), SF(12), TA-Ikenberry (MO), TO-Ikenberry (MO)

***Platyhypnidium***

***riparioides*** (Hedw.) Dix. GR-Harvill 2794 (MO), LI(1), SM-Voth 15758 (MO), TA(1)

***Steerecleus***

***serrulatum*** (Hedw.) Robins. DA(15)

***Tomentypnum***

***nitens*** (Hedw.) Loeske no county given (13)

BRYACEAE

***Brachymenium***

***systylium*** (C. Müll.) Jaeg. DA(13), OT(12)

***Bryum***

***algovicum*** Sendtn. *ex* Müll var. ***algovicum*** SM(12), SF(12)

***argenteum*** Hedw. CI-Bleakly 3239 (NMCR), CO-Glime 1418A (MO), DA(12), ED(5), GR-Daisy (NMCR), LI-Ikenberry (MO), LU(4), MK-Bleakly 2810 (NMCR), MR-Standley 3994 (NMCR), OT-Ikenberry (MO), SM(12), SA(12), SF(12), SI-Allred 7023 (NMCR), SO-Kearns 17 (MO), TA-Glime 1405 (MO), TO-Ikenberry (MO), UN-Darigo & Darigo 2992 (MO)

***billarderi*** Schwaegr. DA(10), GR(10), HI(10), LI-Ikenberry (MO), SF-Ikenberry (MO)

***caespiticium*** Hedw. CO-Glime 1421B (MO), LI(1), SM(1), SA(1), SF(1), TA(1)

***capillare*** Hedw. var. ***capillare*** DA(15), GR-Allred 7216 (NMCR), LI-Ikenberry (MO), LU(4), OT-Ikenberry (MO), SM(12), SF(12), TA-Voth & Voth 15885 (MO), TO-Forbes 419A (MO)

***cyclophyllum*** (Schwaegr.) Bruch & Schimp. *in* B.S.G. DA(15)

***dichotomum*** Hedw. BE(1), DA-Allred 7071 (MO), HI-Todsen 90-1 (MO), MK-Forbes 207 (NMCR)

***gemmiparum*** De Not. CA-Freece & Turner 2707 (MO), DA(9), GR-Adams 104 (NMCR), RA-Flowers 6016 (MO), SM-Ogle (MO)

****incrassatolimbatum*** Card. GR-Harvill 2795 (MO)

***lisae*** De Not. var. ***cuspidatum*** (Bruch & Schimp. *in* B.S.G.) Marg. BE-Ikenberry 662B (MO), CO-Glime 1422 (MO), DA(14), GR-Allred 7184 (NMCR), LI-Ikenberry (MO), MR-Standley (NMC), SM(14), SA(14), SF(14), TA-Ikenberry (MO)

***lonchocaulon*** C. Müll. no county given (12)

***miniatum*** Lesq. CA-Allred 7205 (MO), DA(15), GR-Adams (NMCR), LI-Allred 7109 (NMCR)

***muehlenbeckii*** Bruch & Schimp. *in* B.S.G. DA(9), RA-Flowers 6025A (MO)

***pallens*** (Brid.) Sw. *in* Röhl. CI-Ivey 73 (NMCR), SF(1), TA(1)

***pallescens*** Schleich. *ex* Schwaegr. DA(1), GR(1)

***pseudotriquetrum*** (Hedw.) Gaertn. et al. CA-Allred 6560 (NMCR), DA(15), LI-Allred 6730 (NMCR), MK-Forbes 210.1 (NMCR), MR-Standley (NMC), OT-Ogle (MO), SM(12), SA(12), SI-Anderson 7223 (NMCR), TA-Ikenberry (MO)

***pyriferum*** Crundw. & H. Whiteh. DA(9), SI(10)

***turbinatum*** (Hedw.) Turn. BE-Wooten (MO), DA-Worthington 21564 (NMCR), GR-Allred 7185 (NMCR), SM(12), SF(12)

***uliginosum*** (Brid.) Bruch & Schimp. *in* B.S.G. no county given (12)

***Leptobryum***

***pyriforme*** (Hedw.) Wils. DA(15), SM(12), SA-Glime 1429B (MO), SF(12), TA-Ogle (MO)

***Pohlia***

***cruda*** (Hedw.) Lindb. CA-Allred 6562 (NMCR), GR-Adams 62 (NMCR), SM(12), SF(2), TA-Ogle (MO), TO-Forbes (NMCR)

***drummondii*** (C. Müll.) Andrews DA(15)

***elongata*** Hedw. var. ***elongata*** DA(1), HI(1), SO(1)

***nutans*** (Hedw.) Lindb. CO-Glime 1421A (MO), DA-Worthington 25477 (NMCR), SM(12), SA-Allred 6406 (NMCR), SF(12), TA-Ikenberry (MO)

***wahlenbergii*** (Web. & Mohr) Andrews CA-Crutchfield & Campbell 135 (MO), DA(15), GR-Harvill 2797 (MO), SA-L Weber B-10939 (MO), TO(8)

***Rhodobryum***

***ontariense*** (Kindb.) Par. *in* Kindb. DA(16), GR-Metcafe 467.1 (NMC), OT(13)

BRYOXIPHIACEAE

***Bryoxiphium***

***norvegicum*** (Brid.) Mitt. SA(1)

CLIMACIACEAE

***Climacium***

***americanum*** Brid. CO(13), MR(13), RA(13)

***dendroides*** (Hedw.) Web. & Mohr MR-Allred 6840 (NMCR), SM(12), TA-Ikenberry (MO)

DICRANACEAE

***Dichodontium***

***pellucidum*** (Hedw.) Schimp. TA(1)

***Dicranella***

***varia*** (Hedw.) Schimp. BE-Ikenberry (MO), TO(9)

***Dicranoweisia***

***cirrata*** (Hedw.) Lindb. *ex* Milde no county given (12), CA-Richmond (NMCR), LI-Ogle (MO)

***crispula*** (Hedw.) Lindb. *ex* Milde CI-Ivey 201 (NMCR), CO-Ikenberry (MO), LI-Barnett 44 (NMCR), MR-Allred 6957 (NMCR), OT-Ogle (MO), SM(12), SA(12), SF-Ikenberry (MO), TA-Ogle (MO)

***Dicranum***

***fuscescens*** Turn. var. ***fuscescens*** TA(1)

***muehlenbeckii*** Bruch & Schimp. *in* B.S.G. SM(12), TA-Ikenberry 523 (MO)

***rhabdocarpum*** Sull. CA-Allred 6538 (NMCR), GR-Holzinger 5010 (MO), LI-Wooten & Standley 3784 (NMC), MR-Allred 6924 (NMCR), OT-Ikenberry 980 (MO), SM(12), SA(12), SF(12), SO-Kearns 2 (MO), TA-Ikenberry (MO)

***scoparium*** Hedw. CA(1), CO-Glime 1421 (MO), LI(1), MR(1), OT-Allred 7084 (NMCR), SM(1), SF(1), TA(1)

***Oncophorus***

***virens*** (Hedw.) Brid. SF(12), TA-Ikenberry (MO)

***wahlenbergii*** Brid. SM-Studhalter 15747 (MO), TA(1)

***Orthodicranum***

***montanum*** (Hedw.) Loeske OT-Ogle (MO), SM(12)

***Paraleucobryum***

***enerve*** (Thed. *in* Hartm.) Loeske SM(12)

***longifolium*** (Hedw.) Loeske SM(12), SF(12)

***Symblepharis***

***vaginata*** (Hook.) Wijk & Marg. GR(10), LI(12), OT-Allred 7005A (NMCR)

DITRICHACEAE

***Ceratodon***

***purpureus*** (Hedw.) Brid. var. ***purpureus*** BE-Ikenberry (MO), CA-Allred 6547 (NMCR), CI-Allred 6533 (NMCR), CO-Darigo & Darigo 2982 (MO), DA(15), GR-Holzinger 606 (MO), LI-Ikenberry (MO), LU(4), MR-Pursell 3002A (MO), OT-Ikenberry (MO), SM(12), SA(12), SF(12), SI-Allred 7024 (NMCR), SO-Worthington 26606 (NMCR), TA-Ikenberry (MO), TO-Ikenberry (MO)

****stenocarpus*** Bruch & Schimp. *in* B.S.G. BE-Ikenberry 12 (MO)

***Distichium***

***capillaceum*** (Hedw.) Bruch & Schimp. *in* B.S.G. var. ***capillaceum*** MR-Allred 6865 (NMCR), SM(12), SA(12), SF(12), TA-Ikenberry (MO)

***Ditrichum***

***flexicaule*** (Schwaegr.) Hampe MR(1), TA-Ikenberry (MO)

***Saelania***

***glaucescens*** (Hedw.) Broth. *in* Bomanns. & Broth. SM(12)

ENCALYTACEAE

***Encalypta***

***ciliata*** Hedw. DA(15), SM(12), SF(12)

***rhaptocarpa*** Schwaegr. MR-Allred 6856 (NMCR), SF(13)

***vulgaris*** Hedw. CO-Waller (MO), DA(15), LI-Ikenberry (MO), OT-Bird 3453 (MO), SM(12), SF(12), TA-Pursell 3055A (MO)

ENTODONTACEAE

***Entodon***

**concinnus** (De Not.) Par. LI-Ikenberry (MO), OT-Allred 7003 (NMCR), SM(12)

**schleicheri** (Schimp.) Demeter CA-Metcafe 480 (NMCR), LI(15) Changed from *E. cladorrhizans* (Hedw.) C. Mull, Mahler 1978, LI-Ogle (MO), SM-Ikenberry (MO)

**sullivantii** (C. Müll.) Lindb. no county given (13)

FABRONIACEAE

***Fabronia***

**ciliaris** (Brid.) Brid. var. **ciliaris** BE(12), DA(15), LU(4), SM(12), SF(15)

**ciliaris** (Brid.) Brid. var. **wrightii** (Sull.) Buck DA(12), LI-Wooten & Standley (NMC), LU-Worthington 21158 (NMCR), TO-Forbes 252 (NMCR)

**pusilla** Raddi DA(15)

FISSIDENTACEAE

***Fissidens***

**bryoides** Hedw. var. **bryoides** DA(15), SM(12)

**bryoides** Hedw. var. **pusillus** (Wils.) Pursell DA(10). Name change from *F. exiguus f. emarginatus* Grout., per R. Pursell.

***bryoides** Hedw. var. **viridulus** (Sw.) Broth. HA-Pursell 2986 (MO), TA-Pursell 3056 (MO), *UN-Pursell 2960A (MO)

**crispus** Mont. Name change from *F. limbatus* Sull. (Mahler 1978), per R. Pursell, DA-Stark 864 (MO). Annotated from *F. sublimbatus* Grout, by R. Pursell, HA-Pursell 2986 (MO)

**fontanus** (B. Pyl.) Steud. GR-Harvill 2796 (MO), MR(15)

**littlei** (Williams) Grout DA(12)

**sublimbatus** Grout DA-Stark & Castetter 1033 (MO). Annotated from *F. obtusifolius* Wils. var. *apiculatus* Grout, by R. Pursell, ED(5), GU(15), QU(4), SM-Weber et al B-44670 (MO)

FONTINALACEAE

***Fontinalis***

**antipyretica** Hedw. var. **antipyretica** no county given (12), GR-Whittemore & Kearns 6034 (MO)

**hypnoides** Hartm. var. **hypnoides** CA(1), SI(1), TA(1)

**neomexicana** Sull. & Lesq. CA-Adams 269 (NMCR), SM-Allred 6368 (MO), SF(12)

FUNARIACEAE

***Entosthodon***

**rubiginosus** (Williams) Grout DA(10)

***Funaria***

***calvescens** Schwaegr. LI-Ikenberry (MO)

**hygrometrica** Hedw. DA(12), GR-Adams (NMCR), HI-Worthington 14102 (NMCR), LI-Crowell (MO), LU-Worthington 11938 (NMCR), OT-Crutchfield 79 (MO), SM(2), SA-Glime 1430 (MO), SF(2), SI-Sivinski 3634 (NMCR)

**muehlenbergii** Turn. DA(15)

***Physcomitrium***

**pyriforme** (Hedw.) Hampe DA(10)

GIGASPERMACEAE

***Lorentziella***

***imbricata*** (Mitt.) Broth. OT(1)

GRIMMIACEAE

***Coscinodon***

***calyptratus*** (Drumm.) Kindb. CA-Adams 2 (NMCR), CI-Allred 6535 (NMCR), RA-Standley & Bollman 10725 (MO), SM(12), SA-Glime 1407 (MO), SF-Crosby 15366 (MO), TA-Ikenberry (MO)

***cribrosus*** (Hedw.) Spruce DA(15) Annotated from *G. tenerrima* Ren. & Card. by J. Muñoz 1998, HI(9)

***Grimmia***

***anodon*** Bruch & Schimp. *in* B.S.G. DA(12), HI-Worthington 20677 (NMCR), LU-Harvill 2822 (MO), MK-Forbes (NMCR), SJ-Sivinski 3779 (NMCR), SA(12), SI-Allred 7030 (NMCR), SO-Kearns 11 (MO)

****elatior*** Bruch *ex* Bals.-Criv. & De Not. SF-Arsène 19389 (PC). Annotated from *G. arizonae* Ren. & Card. by J. Muñoz 1998

***laevigata*** (Brid.) Brid. BE(12), CA-Allred 6563 (NMCR), DA(15)

***longirostris*** Hook. (name change from *G. affinis* Hoppe & Hornsch. *ex* Hornsch., also includes previous literature report of *G. donniana* Sm., per J. Muñoz 1998). CA-Allred 6543 (NMCR), CO-Glime 1409A (MO), DA-Allred 7048 (NMCR), HA-Pursell 2973 (MO), LI-Ikenberry 861 (MO), LU-Worthington 20108 (NMCR), MR(12), SM(12), SA-Allred 6426 (NMCR), SF(12), TA-Ikenberry (MO), UN-Pursell 2954 (MO)

****montana*** Bruch & Schimp. *in* B.S.G. DA-Stark & Castetter 1169 (MO). Annotated from *G. arizonae* Ren. & Card. by J. Muñoz 2000.

***orbicularis*** Wilson GR-Worthington 20843 (NMCR), RA(12)

***ovalis*** (Hedw.) Lindb. DA(15), GR-Daisy (NMCR), HI-Worthington 26582 (NMCR), LI-Ogle (MO), MR(12), SM(12), SF(12)

***pilifera*** P. Beauv. (name change from *G. arizonae* Ren. & Card., per J. Muñoz, 1999) DA(15), HI-Harvill 2808 (MO), LU-Harvill 2823 (MO), SM(12)

***plagiopodia*** Hedw. no county given (12), CO-Glime 1411 (MO)

***poecilostoma*** Cardot & Sebille BE(12), DA(15), GR-Daisy (NMCR), SO-Kearns 14 (MO)

***pulvinata*** (Hedw.) Sm. var. ***pulvinata*** DA(12), GR-Allred 7217 (NMCR), HI-Worthington 26492 (NMCR), SA(12), SO-Weber & Shushan 16796 (NY)

****ungeri*** Jur. MR-Allred 6813 (NMCR) Per J. Muñoz 2000, sporophytes are needed to separate positively from *G. montana* Bruch & Schimp. *in* B.S.G.

***Jaffueliobryum***

***raui*** (Austin) Thér. CH(9), CO-Darigo 2984 (MO), ED(5), GU(9), HA(9), MK-Forbes 209 (NMCR), QU(9), RA-Savinski 3768 (NMCR), RO-Ikenberry 458 (MO), SM(9), SF(9), SO-Allred 7341 (NMCR), UN(9), VA(9)

***wrightii*** (Sull.) Thér. BE(12), CH-Ikenberry 14 (MO), DA(12), ED(5), HI-Worthington 20678 (NMCR), LI-Allred 6790 (NMCR), MK-Forbes 210 (NMCR), RA-Sivinski 3768 (NMCR), SF(12), SO-Ikenberry 868 (MO), TO-Forbes 69.1 (NMCR)

***Schistidium***

***apocarpum*** (Hedw.) Bruch & Schimp. *in* B.S.G. BE-Ikenberry (MO), CA-Allred 6554 (UMCR), DA(15), GR-Harvill 2800 (MO), HA-Pursell 2990 (MO), HI-Worthington 26586 (NMCR), LI-Ikenberry (MO), MR-Allred 6848

(NMCR), OT-Ikenberry (MO), SM(10), SA-Allred 6515 (NMCR), SF(12), SO-Kearns 18 (MO), TA-Ikenberry (MO), TO-Ikenberry (MO), UN-Darigo & Darigo 2990 (MO)

***rivulare*** (Brid.) Podp. var. ***rivulare*** DA-Worthington 22245 (NMCR), GR-Daisy (NMCR), LI-Worthington 25493 (NMCR), SM(12)

***rivulare*** (Brid.) Podp. var. ***latifolium*** (Zett.) Crum & Anderson DA(15), MR-Allred 6835 (NMCR), TA-Ikenberry 849 (MO)

HEDWIGIACEAE

***Braunia***

***secunda*** (Hook.) Schimp. *in* B.S.G. HI(1), SI(1)

***Hedwigia***

***ciliata*** (Hedw.) P. Beauv. DA(15), GR-Allred 7188.1 (NMCR), LI-Ogle (MO), MR-Allred 6818 (NMCR), SM(12), SA-Glime 1429A (MO), SF(12), TA-Ikenberry (MO)

HYLOCOMIACEAE

***Hylocomium***

***splendens*** (Hedw.) Schimp. *in* B.S.G. SF(12)

***Pleurozium***

***schreberi*** (Brid.) Mitt. CA(13)

HYPNACEAE

***Homomallium***

***mexicanum*** Card. var. ***mexicanum*** BE-Ikenberry (MO), CO-Sivinski 4538 (NMCR), DA(15), GR(12), HA-Pursell 2983 (MO), HI-Harvill 2817 (MO), LI(12), LU-Worthington 20112 (UTEP), MR-Pursell 2998 (MO), OT(12), SM(12), SI-Worthington 24793 (NMCR), SO-Worthington 26608 (NMCR), TO-Ikenberry (MO)

***mexicanum*** Card. var. ***latifolium*** Card. LI(12), SM(12)

***Hypnum***

***cupressiforme*** Hedw. var. ***cupressiforme*** DA(12), LI-Barnett 27 (NMC), OT-Wooten 3755 (NMC), RA-Sivinski 4452 (NMCR), SM(12), SI-Worthington 25417 (NMCR)

***lindbergii*** Mitt. CO-Ikenberry (MO), MR-Allred 6863 (NMCR), SM(12), TA-Ikenberry (MO)

***pallescens*** (Hedw.) P. Beauv. var. ***pallescens*** SA-Allred 6430 (MO), TA(15)

***pratense*** (Rabenh.) W. Koch *ex* Spruce MR(1)

***revolutum*** (Mitt.) Lindb. CA-Anderson & Shaw 24621 (MO), CO-Ikenberry (MO), DA-Allred 7049 (NMCR), GR-Holzinger (MO), HI-Harvill 2818 (MO), LI-Ikenberry (MO), MR-Allred 6811 (NMCR), OT-Ikenberry (MO), SM(12), SA(12), SF(12), TA-Ikenberry (MO), UN-Merrill 11706 (MO)

***vaucheri*** Lesq. DA(16), GR-Metcafe 483 (NMCR), LI-Ikenberry (MO), OT-Ikenberry 707 (MO), SM-Ogle (MO), TO(9), UN-Merrill 11705 (MO)

***Isopterygiopsis***

***pulchella*** (Hedw.) Iwats. TA(1)

***Isopterygium***

***tenerum*** Mitt. DA(1) Stark 948 (MO) and Stark & Castetter 1106 (MO). Annotated from *Isopterygiopsis pulchella* (Hedw.) Iwats., by Bruce Allen 1997; specimens had smooth, not papillose rhizoids, which were external to leaf base, not in leaf axils. Based on these two collections, it is likely that

*Isopterygium pulchellum* (Hedw.) Jaeg. & Sauerb. [= *Isopterygiopsis pulchella* (Hedw.) Iwats.] reported by Stark & Castetter 1982, is actually *Isopterygium tenerum* Mitt.

***Platydictya***

***jungermannioides*** (Brid.) Crum no county given (12), BE-Ikenberry (MO), GR-Metcafe (MO), TA-Voth & Voth 15911 (MO)

***Platygyrium***

***fuscoluteum*** Card. GR(12), LI-Ikenberry 396A (MO), OT(12), SM-Studhalter 15751 (MO)

***Pseudotaxiphyllum***

***homomallifolium*** (Redf.) Irel. DA(10)

***Pylaisia***

***polyantha*** (Hedw.) B.S.G. BE-Ikenberry (MO), CO-Darigo & Darigo 2988 (MO), HI-Harvill 2813 (MO), LI-Ikenberry (MO), OT(12), SM(12), SF-Ikenberry (MO), TA-Ikenberry 604 (MO), TO-Ikenberry (MO)

***Taxiphyllum***

***deplanatum*** (Bruch & Schimp. *ex* Sull.) Fleisch. BE-Ikenberry (MO), DA(15), LI-Ikenberry (MO), SM(12)

***taxirameum*** (Mitt.) Fleisch. DA(15)

LESKEACEAE

***Claopodium***

***pellucinerve*** (Mitt.) Best no county given (12), CA-Adams (NMCR)

***Haplocladium***

***angustifolium*** (Hampe & C. Müll. *in* C. Müll.) Broth. GR-Harvill 2805A (MO), LI(1), OT(1)

***microphyllum*** (Hedw.) Broth. DA(16), HI-Harvill 2820 (MO), LI-Ikenberry (MO), SM(12)

***Leptopterigynandrum***

***austro-alpinum*** C. Müll GR(1)

***Lescuraea***

***arizonae*** (Williams) P. Wils. & Norris BE-Ikenberry (MO), DA(16), GR-Holzinger (MO), LI-Ikenberry (MO) SM(12), SF(12), TA-Ikenberry (MO)

***saxicola*** (Schimp. *in* B.S.G.) Milde TA(13)

***Leskeella***

***nervosa*** (Brid.) Loeske CA-Adams (NMCR), DA(16), LI-Allred 6450 (NMCR), LU-Worthington 20113 (NMCR), MR-Allred 6862 (NMCR), TA-Waller (MO)

***Lindbergia***

***brachyptera*** (Mitt.) Kindb. DA(15), SM(12)

***mexicana*** (Besch.) Card. DA(15)

***Pseudoleskeella***

***sibirica*** (Arnell) P. Wils. & Norris no county given (13)

***tectorum*** (Funck *ex* Brid.) Kindb. *in* Broth. BE-Ikenberry 662 (MO), CO-Glime 1410 (MO), DA(12), LI-Ikenberry (MO), OT-Ikenberry (MO), SM(120), SA(12), SO-Kearns 19 (MO), TA-Voth & Voth 15894 (MO), TO-Ikenberry (MO), UN-Pursell 2959 (MO)

***Pseudoleskea***

***incurvata*** (Hedw.) Loeske var. ***incurvata*** MR(13), OT(13)

***radicosa*** (Mitt.) Mac. & Kindb. var. ***radicosa*** MR-Allred 6921 (NMCR), TA(13)

MNIACEAE

***Mnium***

***arizonicum*** Amann CO-Ikenberry (MO), LI-Allred 6724 (NMCR), MR-Allred 6918 (NMCR), OT-Ikenberry (MO), SM-Ogle (MO), SA(12), SF(12), TA-Ikenberry (MO)

***blyttii*** Bruch & Schimp. *in* B.S.G. LI-Allred 6804 (NMCR), SF(12), TA-Allred 7167 (NMCR)

***marginatum*** (With.) Brid. *ex* P. Beauv. BE-Ikenberry (MO), CO-Standley 13772B (MO), GR-Metcafe (MO), LI-Allred 6728 (NMCR), SM(12), SA(12), SF(12), TA-Ikenberry (MO)

***thomsonii*** Schimp. SM-Crosby 16543 (MO), SF(12)

***Plagiomnium***

***cuspidatum*** (Hedw.) T. Kop. CI-Ivey 309 (NMCR), DA-Worthington 22173 (NMCR), GR-Metcafe 470 (NMCR), LI-Ikenberry (MO), MR-Allred 6843 (NMCR), SM(12), SA(12), SF-Ikenberry (MO), TA-Ikenberry (MO)

***ellipticum*** (Brid.) T. Kop. MR-Allred 6857 (NMCR), SM(1)

***rostratum*** (Schrad.) T. Kop. SF(12)

***Rhizomnium***

***magnifolium*** (Horik.) T. Kop. no county given (13)

***pseudopunctatum*** (Bruch & Schimp.) T. Kop. CO(13), SA-Allred 6403 (NMCR)

***punctatum*** (Hedw.) T. Kop. SM-Allred 6354 (MO), TA(1)

NECKERACEAE

***Metaneckera***

***menziesii*** (Hook. *in* Drumm.) Steere GR(12) original Socorro site is Grant Co.

***Neckera***

***pennata*** Hedw. DA(15), SM(12), SA(12), SF(12), SI(9), TA-Glime 1378 (MO)

ORTHOTRICHACEAE

***Orthotrichum***

***alpestre*** Hornsch. *in* B.S.G. BE(12), CO-Glime 1413 (MO), DA-Worthington 21126 (NMCR), OT-Vaarama 64-195-06B (MO), SA-Allred 6409 (NMCR), TA-Ikenberry (MO)

***anomalum*** Hedw. BE(12), CA(12), DA(15), HA-Pursell 2972 (MO), LI(12), MR(12), SJ(12), SM(12), SA-Bird 3463 (MO), SF(12), TA-Ikenberry (MO), UN(12), VA(12)

***diaphanum*** Brid. CA-Allred 6585 (NMCR), DA(12), HI-Worthington 26332 (NMCR), LU-Harvill 2824 (MO), MR(12), QU(4), SF(12)

***hallii*** Sull. & Lesq. *in* Sull. CO(12), DA(15), LI(12), MR-Standley 3993 (NMC), RA(12), SM(12), SF(12), TA(12), TO-Ikenberry (MO)

***laevigatum*** Zett. LI(1), TA(1)

***obtusifolium*** Brid. BE(12), OT(12), TA-Ikenberry (MO)

***pumilum*** Sw. DA(15), GR(12)

***pycnophyllum*** Schimp. *in* C. Müll. LI(18)

***rupestre*** Schleich. *ex* Schwaegr. DA(15), LI-Allred 6766 (NMCR), MR-Allred 6946 (NMCR), RA-Griffin 265 (MO), SM(12), SF(12), TA-Ikenberry (MO)

- ***Zygodon***
  - ***viridissimus*** (Dicks.) Brid. var. ***rupestris*** Lindb. *ex* Hartm. SM(12)
- PLAGIOTHECIACEAE
  - ***Plagiothecium***
    - ***denticulatum*** (Hedw.) Schimp. *in* B.S.G. CA(9)
    - ***laetum*** Schimp. *in* B.S.G. OT(8), TA-Ogle (MO)
- POLYTRICHACEAE
  - ***Atrichum***
    - ***selwynii*** Aust. TA(13)
    - ***undulatum*** (Hedw.) P. Beauv. SF(12)
  - ***Polytrichastrum***
    - ***alpinum*** (Hedw.) G. L. Sm. var. ***alpinum*** MR(13)
  - ***Polytrichum***
    - ***juniperinum*** Hedw. CA-Adams (NMCR), SM(12), SF-Standley 3990 (NMC), TA-Ogle (MO)
    - ***lyallii*** (Mitt.) Kindb. no county given (13), MR-Allred (NMCR), TA-Ogle (MO)
    - ***piliferum*** Hedw. MR(13), TA(13), TA-Ikenberry (MO)
    - ***sexangulare*** Brid. SF(12)
- POTTIACEAE
  - ***Aloina***
    - ***rigida*** (Hedw.) Limpr. ED(5), OT(12)
  - ***Astomum***
    - ***phascoides*** (Hook. *ex* Drumm.) Grout LU(4)
  - ***Barbula***
    - ***ehrenbergii*** (Lor.) Fleisch. ED(5)
    - ***unguiculata*** Hedw. LI-Bleakly 3188 (NMCR), QU(4), SM(12), SF(12), SI-Allred 7018 (NMCR)
  - ***Bryoerythrophyllum***
    - ***recurvirostre*** (Hedw.) Chen BE-Ikenberry (MO), CO-Standley (MO), DA(15), HA-Pursell 2985 (MO), LI-Ikenberry (MO), OT-Bird 3455 (MO), SM(12), SF(12), SO-Kearns 3 (MO), TA-Ikenberry (MO)
  - ***Crossidium***
    - ***aberrans*** Holz. & Bartr. DA(9), ED(5)
    - ***crassinerve*** (De Not.) Jur. DA(16), ED(5)
    - ***seriatum*** Crum & Steere DA(3)
  - ***Desmatodon***
    - ***cernuus*** (Hüb.) Bruch & Schimp. *in* B.S.G. no county given (13)
    - ***convolutus*** (Brid.) Grout DA(16), ED(5), SO-Kearns 16 (MO), TO-Forbes 415 (MO)
    - ***guepinii*** Bruch & Schimp. *in* B.S.G. DA(12)
    - ***heimii*** (Hedw.) Mitt. var. ***heimii*** SM(12), SA-Glime 1424A (MO), SF(12)
    - ***latifolius*** (Hedw.) Brid. DA(15), GU-Ikenberry (MO)
  - ***Didymodon***
    - ***fallax*** (Hedw.) Zand. var. ***reflexus*** (Brid.) Zand. SM(12)
    - ***revolutus*** (Card.) Williams DA(15), ED(5), GU-Bleakly 3086 (NMCR), TO-Forbes (NMCR)
    - ***rigidulus*** Hedw. var. ***rigidulus*** DA(15), ED(5), OT-Ikenberry 17 (MO), LI-Allred & Allred 6443 (MO), SM(12), SA(12), TO-Forbes 438 (NMCR)

***rigidulus*** Hedw. var. ***gracilis*** (Schleich. *ex* Hook. & Grev.) Zand. CO-Glime 1417 (MO), DA(12), ED(5), GU-Bleakly 3091 (NMCR), LI-Ogle (MO), OT-Ikenberry (MO), QU(4), SM(12)

***rigidulus*** (Hedw.) var. ***icmadophilus*** (Schimp. *ex* C. Müll.) Zand. LI(1)

***tophaceus*** (Brid.) Lisa DA(12), ED(5), GU-Clebsch NM2 (MO), LU-Harvill 2825 (MO), OT-Allred 7384 (MO), SM(12), SA(12), SI-Allred 7024 (NMCR), SO-Allred 6796 (NMCR), TO-Ikenberry 464A (MO)

***vinealis*** (Brid.) Zand. var. ***vinealis*** DA(13), GR-Allred 7184.1 (MO), LI-Ikenberry (MO), OT-Ikenberry (MO), TO-Ikenberry (MO)

***vinealis*** (Brid.) Zand. var. ***luridus*** (Hornsch. *in* Spreng.) Zand. DA(15), SA-Glime 1424 (MO), SO-Kearns 7 (MO)

***Eucladium***

***verticillatum*** (Brid.) Bruch & Schimp. *in* B.S.G. DA-Allred 7317 (NMCR), ED(5), GR-Harvill 2793 (MO), RA-Flowers 6025 (MO), SM(12), TO-Ikenberry (MO)

***Gymnostomum***

***aeruginosum*** Sm. DA(15), SM(12)

***Hymenostylium***

***recurvirostre*** (Hedw.) Dix. DA-Allred 7318 (NMCR), ED(5), OT-Allred 7375 (NMCR), SM(12)

***Leptodontium***

***flexifolium*** (With.) Hampe *in* Lindb. DA(15), GR(12), HI-Harvill 2813 (MO)

***Molendoa***

***sendtnerianum*** (Bruch & Schimp. *in* B.S.G.) Limpr. DA(9), ED(5), QU(4)

***Phascum***

***cuspidatum*** Hedw. DA(9), LU(4), SI(9)

***Pleurochaete***

***squarrosa*** (Brid.) Lindb. ED(5), also ED-Ikenberry (MO)

***Pottia***

***arizonica*** Wareh. var. ***mucronulata*** Wareh. DA(9)

***bryoides*** (Dicks.) Mitt. HI(1)

***nevadensis*** Card. & Thér. DA(10)

***Pseudocrossidium***

***aureum*** (Bartr.) Zand. DA(14), ED(5), HA-Pursell 2995 (MO), SI-Weber & Shushan 10520 (MO), TO-Forbes 69 (NMCR)

***replicatum*** (Tayl.) Zand. CI-Orcutt (FH), DA(15), ED(5), QU(4), SF-Orcutt (FH)

***Pterygoneurum***

***ovatum*** (Hedw.) Dix. DA(12), MK-Forbes (NMCR)

***subsessile*** (Brid.) Jur. DA(9), SF-Crosby 15371 (MO)

***Rhexophyllum***

***subnigrum*** (Mitt.) Thér. *ex* Hilp. SM(12)

***Syntrichia***

***fragilis*** (Tayl.) Ochyra DA(15), LI-Ikenberry (MO), SM(12)

***pagorum*** (Milde) Amann DA(15), HI-Todsen 90-8 (MO), OT-Ikenberry 723 (MO), SM(12)

***papillosa*** (Wils.) Jur. BE(12), DA(15)

  - ***ruralis*** (Hedw.) Web. & Mohr BE(12), CA-Adams (NMCR), CH-Ikenberry (MO), CI-Allred 6536 (NMCR), CO-Darigo 2987 (MO), DA(15), ED-Ikenberry (MO), GR-Holzinger 575 (MO), GU-Ikenberry (MO), HI-Harvill 2809 (MO), LI-Ikenberry (MO), LU(4), MK-Sivinski 4366 (NMCR), MR-Allred 6810 (NMCR), OT-Maynard 284 (MO), RA-Allred 6530 (NMCR), SM(12), SA(12), SF(12), SI-Allred 7037 (NMCR), SO-Kearns 5 (MO), TA-Ikenberry (MO), TO-Ikenberry (MO)
- ***Timmiella***
  - ***anomala*** (Bruch & Schimp. *in* B.S.G.) Limpr. DA(16)
- ***Tortella***
  - ***humilis*** (Hedw.) Jenn. SI(9)
  - ***tortuosa*** (Hedw.) Limpr. DA(15), TA-Ikenberry (MO)
- ***Tortula***
  - ***bartramii*** Steere *in* Grout BE-Ikenberry (MO), DA(15), HA(15), LI-Allred & Allred 6438 (MO), LU(4), MR(15), SM-Weber & Kunkel B44678 (MO)
  - ***brevipes*** (Lesq.) Broth. DA-Allred 7071A (MO), HI(1)
  - ***caninervis*** (Mitt.) Broth. no county given (12)
  - ***chisosa*** Magill et al. DA(16)
  - ***inermis*** (Brid.) Mont. DA(12), LI-Ikenberry (MO), LU-Worthington 21157 (NMCR)
  - ***intermedia*** (Brid.) Berk. CO(1), DA(11)
  - ***mucronifolia*** Schwaegr. DA-Allred 7295 (MO), RA-Griffin 262 (MO), SM(12), SF(12), TA-Ogle (MO)
  - ***norvegica*** (Web.) Wahlenb. *ex* Lindb. DA(1), HI(1), LU(4), TA-Merello 1980 (MO).
  - ***obtusifolia*** (Schwaegr.) Math. CO-Darigo 2986 (MO), DA(15), SM(12), SF(12)
  - ***obtusissima*** (C. Müll.) Mitt. DA(9), SI(9), SO-Kearns 8 (MO)
  - ***papillosissima*** (Copp.) Broth. no county given (15)
  - ***plinthobia*** (Sull. & Lesq.) Sull. DA(12)
  - ***rhizophylla*** (Sak.) Iwats. & Saito DA(10), LU(4)
- ***Trichostomopsis***
  - ***australasiae*** (Grev. & Hook.) Robins. DA(10), ED(5), SI(10)
- ***Trichostomum***
  - ***brachydontium*** Bruch *in* F. Mull. DA(10)
  - ***crispulum*** Bruch *in* F. Mull. DA(10)
  - ***sweetii*** (Bartr.) Stark DA(17)
  - ***tenuirostre*** (Hook. & Tayl.) Lindb. LU(10)
- ***Weissia***
  - ***andersoniana*** Zand. DA(9), TO-Forbes 419 (MO)
  - ***condensa*** (Voit) Lindb. DA-Barnett (NMCR), LI-Allred 6794 (NMCR), LU(4), OT-Anderson 7201 (NMCR), QU(4), SM(12), SI-Allred 7021 (NMCR), SO-Anderson 7213 (NMCR)
  - ***controversa*** Hedw. BE(12), DA(12), HA-Pursell 2987 (MO), LI-Allred 6791 (NMCR), LU(4), MR-Pursell 3002 (MO), OT-Allred 6992 (NMCR), QU(4), RO-Gwin (MO), SM(12), SO-Kearns 4 (MO), TA-Pursell 3055 (MO), UN-Pursell 2969 (MO)
  - ***ligulaefolia*** (Bartr.) Grout DA(15), LI-Forbes 226 (NMCR), LU(4)

PTYCHOMITRIACEAE

***Ptychomitrium***
***sinense*** (Mitt.) Jaeg. DA(10), HA-Pursell 2972A (MO), HI(14), SI(10)

RHYTIDIACEAE
***Rhytidium***
***rugosum*** (Hedw.) Kindb. CA-Allred 6548 (NMCR), DA-Worthington 21124 (MO), GR-Allred 7190 (NMCR), MR-Standley 3995 (NMC), SM(12), SF(12)

SPLACHNACEAE
***Tayloria***
***acuminata*** Hornsch. no county given (13)

STEREOPHYLLACEAE
***Stereophyllum***
***radiculosum*** (Hook.) Mitt. no county given (12)

TETRAPHIDACEAE
***Tetraphis***
***pellucida*** Hedw. OT(1), SA(1), TA-Ikenberry (MO)

THUIDIACEAE
***Abietinella***
***abietina*** (Hedw.) Fleisch. SM(12), SF(12), TA-Glime 1379 (MO)
***Thuidium***
***delicatulum*** (Hedw.) Schimp. *in* B.S.G. SM(12), SF(12)
***philibertii*** Limpr. no county given (12), SM-Ikenberry (MO)

TIMMIACEAE
***Timmia***
***austriaca*** Hedw. BE-Ikenberry (MO), SM(12)
***megapolitana*** Hedw. var. ***bavarica*** (Hessl.) Brid. BE-Ikenberry 662F (MO), DA-Worthington 22178 (NMCR), SM(12), SA(12), TA-Ikenberry (MO)

**Table 1. Key to Distributional Information**

1. Allred, K. W., C. Darigo & R. D. Worthington. 1998. Additions to the Moss Flora of New Mexico. Evansia 15: 95-98.
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# Long-Term Storage of TLC Data

**Robert S. Egan**[1]

For 30 years thin-layer chromatography has been used routinely to determine chemical characteristics of lichen specimens as an aid in identification. This standardized procedure employs glass-backed TLC silica gel plates sprayed with 10% sulfuric acid for visualization purposes (Culberson & Kristinson 1970, Culberson 1972). For most of us, however, the long-term storage techniques for these plates as a permanent record have been unsatisfactory. Over time the colored spots fade and the silica gel can easily be dislodged and lost from the glass. In addition, large numbers of plates are heavy and take up considerable storage space. I recall visiting Mason Hale at the Smithsonian Institution and seeing many wooden crates of TLC plates piled in his office. Several years ago I gave up keeping the actual glass plates but began to photocopy the plates and to keep these record sheets in a notebook. Although this technique retained the Rf information and took less space, the color data for individual chemical compounds was lost. Color photocopies were much too expensive and too difficult to obtain.

Lately I have begun a new procedure which retains all the color and Rf data from TLC plates while solving the previous problems. I create a digital scan of the TLC plates and maintain these image records on my computer. The procedure is simple. Once I have completed a chromatogram of a number of specimens (usually 18) and have made notes about the chemical substances in each specimen, I scan the TLC plate on my flatbed scanner. I save the image as a .jpg file (other formats would be fine) and import the image into a photo-editing program to fine tune the color, making sure it matches the original. I normally scan the TLC plate the next day to let the sulfuric acid charred spots "set" their colors. The chemical determinations made for each tested specimen on the TLC plate are typed or printed on a separate, permanent chemical label that I place in the specimen packet. Data on this label include the unique TLC plate identifying number and the lane number for that particular specimen, e.g. TLC509-14. In addition, I routinely include the date the TLC determination was made and the solvent system used (Culberson 1972, White & James 1986). The digital scan files are maintained in a separate folder on my computer and backed up onto disk. These digital files can be reviewed anytime and Rf values can be determined later (since the distance from origin to solvent front is a standard 10 cm). The original colors for the spots are accurately retained.

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Using digital scan files for the TLC plates has other advantages. I am currently modifying my herbarium record database to include new fields (TLC Plate Code and Image Scan; chemical substance determinations are already in the database for tested specimens) so that the original TLC plate scan file can be displayed when viewing database records. If identification of a lichen substance is in doubt, the original scan file can be attached to an e-mail message and sent to anyone who might be able to assist with chemical determinations. If needed, good quality color prints for posters can be made on the current color ink-jet or laser-jet printers. The scanned TLC plate images have already proven useful in electronic presentations for classes and seminars, and in the future these images may be employed in electronic publications (world-wide-web, CD-ROM, or DVD). Malcolm & Garnock-Jones (2000) recently published excellent direct image scans of actual lichen specimens!

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## Eagle Hill Field Seminars, 2001

Advanced, professional, and specialty natural history seminars and related art workshops on the coast of Maine this summer. The five bryophyte or lichen courses, dates, and instructure are listed below.

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Bryophytes and Bryophyte Ecology, June 24-30, Nancy Slack
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Fungi on Lichens (Lichenicolous Fungi), September 2-8, David Hawksworth

For more detailed information, a brochure, and registration forms contact Humboldt Field Research Institute, Dyer Bay Road, P.O. Box 9, Steuben, ME 04680-0009. http://maine.maine.edu/~eaglhill

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# A New Inland Site in New York State for *Sphagnum angermanicum*

Thomas Phillips[1] and Norton G. Miller[2]

*Sphagnum angermanicum* Melin has been discovered in Stephentown, Rensselaer County, New York, at Croumb Pond fen (42°34'38"N, 73°26'00"W; elevation ca. 485 m), a location about 200 km inland from the Atlantic Coast. It is abundant on the south side of the fen mat that rings the pond, occurring as the sole peat moss in low hummocks, and sometimes with *Sphagnum fallax* (Klinggr.) Klinggr. in and just above hollows. Also present on drier parts of the fen mat are *Sphagnum bartlettianum* Warnst., *S. brevifolium* (Lindb.) Roell, *S. fuscum* (Schimp.) Klinggr., *S. isoviitae* Flatb., *S. magellanicum* Brid. and *S. henryense* Warnst. In water-filled hollows and pools on the fen mat are *S. torreyanum* Sull., *S. cuspidatum* Ehrh. *ex* Hoffm, and *S. majus* var. *norvegicum* Flatb. The plants of *S. henryense* lacked commissural ridges, were brown in color, and grew on the open peat mat, a habitat similar to that characteristic of *S. papillosum* Lindb.

The following voucher specimens of *Sphagnum angermanicum* from Croumb Pond are in the Herbarium of the New York State Museum (NYS): medium-poor fen off Calvin Cole Road, Stephentown, *Phillips s.n.*; beneath *Chamaedaphne*, low shrub zone, poor fen at Croumb Pond, 1.5 mi northwest of Stephentown center, *Miller 13372*.

The Croumb Pond fen plants of *Sphagnum angermanicum* were well developed (7-10 cm long) and pale green with purple-red, flattened capitular branches. This last characteristic permits plants to be identified in the field, usually without difficulty.

The distribution of *Sphagnum angermanicum* in North America has been thought to be restricted largely to peatlands in eastern coastal areas from New Jersey to southern Labrador, especially those in New Brunswick, Nova Scotia and Newfoundland (Crum, 1984; Maass, 1967). Otherwise, this species is known from southern Norway and central Sweden (*ibid.*). While not a rare peat moss in the New Jersey Pine Barrens or in northeastern coastal Maine, it has been recorded previously only from two places in New York: along the East Branch, Seatuck Creek, Speonk, Suffolk County (Long Island) [*S. Smith & E. Reilly, Jr. 47632* (NYS!)] (Andrus, 1980); and Upper Palmoghatt Bog, Lake Minnewaska, Ulster County [*W. Town 2253* (NYS!)] (Town *et al.*, 1994). The Speonk

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population is thought to be extirpated (R. Andrus, pers. comm.). Croumb Pond, Rensselaer County, New York, is 115 km north of the Ulster County station.

A significant number of inland stations for *Sphagnum angermanicum* have been discovered in recent years. Therefore, this peat moss may be found in other parts of the northeastern United and States and adjacent Canada and under more continental climatic conditions than those near the Atlantic Coast where the species is most frequent. Holcombe (1979), for example, recorded it for the White Mountains, New Hampshire, and a second locality from this state (in the Lake Ossipee region) was discovered on the 1999 A. L. Andrews Foray (R. Andrus, pers. comm.). In addition, Lavoie and Gauthier (1983) and Dignard and Bastian (1990) reported several stations for *S. angermanicum* adjacent to and inland from the St. Lawrence River in Quebec.

The poor fen at Croumb Pond contains a noteworthy peat moss flora. In addition to *Sphagnum angermanicum*, another species of the Atlantic Coast, *S. bartlettianum*, is there. A third significant species, *S. brevifolium*, otherwise known in New York State from several stations in the Adirondack Mountain region in the northern part of the state (Andrus *et al.*, 1994) is also present on the fen mat, occurring with *S. isoviitae* and *S. magellanicum*.

Acknowledgments. We thank Richard Andrus for comments on our collections of *Sphagnum isoviitae* and *S. henryense*, and for identifying plants of *S. brevifolium* from Croumb Pond.

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# The genus *Bruchia* (Musci: Bruchiaceae) in Maine

**Bruce Allen**[1]

*Bruchia,* with 15 species (Rushing 1986), is a genus of very small, ephemeral mosses found on bare soil. As with other ephemeral mosses (*e.g., Ephemerum, Micromitrium, Aphanorregma, Archidium, Phascum, Physcomitrella,* and *Physcomitrium*) *Bruchia* has a short life cycle and is a pioneer of disturbed places such as fallow fields, grassy lawns, and roadside ditches. The genus is cleistocarpous (*i.e.*, lacks an annulus, operculum, and peristome), has mostly pyriform capsules with long, richly stomatose, well-developed necks, a large mitrate calyptra, and large, subreniform, usually highly ornamented spores.

The center of distribution for *Bruchia* appears to be North America (with eleven species), particularly southeastern United States where eight species of the genus are found. *Bruchia* is infrequently collected despite the fact that it commonly has sporophytes and so is easy to identify. One reason *Bruchia* seems to be overlooked is its very small size, another is that it is a winter ephemeral (Rushing 1986). *Bruchia* is known in Maine from a single collection which occurred intimately mixed with and filed under *Physcomitrium pyriforme* (Hedw.) Hampe. The genus was revised by Rushing (1986).

*Bruchia* is named for the German bryologist Philipp Bruch (1781–1847). An Apothecary by trade (Frahm 1995), Bruch was one of the original authors of *Bryologia Europaea.*

*Bruchia* Schwaegr., Sp. Musc. Frond. Suppl. 2(2): 91. 1824.

Plants small or very small, gregarious, green or brownish. Stem simple or sparsely and irregularly branched. Basal leaves small, distant, becoming larger and more crowded above. Upper leaves ovate to lanceolate or subulate from oblong or oblong-ovate bases; costa subpercurrent to percurrent, usually filling the subula; margins smooth to serrulate; upper cells firm or thick-walled, subquadrate, short-rectangular, or oblong-linear, smooth or papillose, basal cells long, narrow, thin-walled, smooth, alar cells not differentiated. Autoicous or paroicous. Setae very short, usually curved. Capsules obovoid to pyriform, immersed to exserted, neck up to 1/2 the capsule length; stomata numerous in capsule neck; annulus absent; operculum absent; peristome absent. Spores large, subreniform, often with distinct proximal and distal sides, warty, spinose, pitted or reticulate. Calyptrae mitrate, lobed at base, smooth or papillose.

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*Bruchia flexuosa* (Sw. *ex* Schwaegr.) C. Müll., Bot. Zeitung (Berlin) 5: 99. 1847.
*Phascum flexuosum* Sw. *ex* Schwaegr., Sp. Musc. Frond. Suppl. 2(1): 1. 1823.
*Bruchia donnellii* Aust., Bull. Torrey Bot. Club 6: 144. 1877.
*Bruchia sullivantii* Aust., Bull. Torrey Bot. Club 6: 143. 1877.

Plants 0.4–3.4 mm high. Leaves erect or flexuose, spreading when dry; upper leaves long-subulate from an oblong or oblong-ovate base, 1–3 mm long, subula as long or longer than the basal part of leaf; acute; costa subpercurrent to percurrent, usually filling the subula; margins smooth to serrulate; upper cells firm or thick-walled, subquadrate to irregularly oblong, smooth or papillose, basal cells long, narrow, thin-walled, smooth, alar cells not differentiated. Autoicous with antheridia in basal or lateral buds or paroicous with antheridia naked in upper leaf axils. Setae 1–3 mm long, straight or curved. Capsules exserted, pyriform, rostrate, neck 1/4 to 1/2 the capsule length; stomata numerous in capsule neck; annulus absent; operculum absent; peristome absent. Spores 26–45 µm, subreniform, spinose or spinose-reticulate. Calyptrae mitrate, lobed at base, smooth. n = 14, 15, 16, 28 (Rushing 1986).

On soil mixed with *Physcomitrium pyriforme*. In Maine known from York (*Thaxter,* May 1904, NEBC) County.

Although Grout (1936) included Maine in the distribution of *Bruchia flexuosa* (as *Bruchia sullivantii*), he did not cite any Maine collections of the species. Rushing (1986) recorded the species from nearby Quebec, Massachusetts (Essex County), and Connecticut (New Haven County). The Maine collection of *Bruchia flexuosa* was made by Roland Thaxter on Kittery Point. Kittery Point is a mecca for Maine ephemerals; Thaxter also collected *Ephemerum serratum*, *E. spinulosum*, and *Micromitrium megalosporum* there.

*Bruchia flexuosa* is the most common species of *Bruchia* in North America and it is also the most variable (Crum & Anderson 1981, Rushing 1986). The species can be autoicous or paroicous and both conditions as well as a mixed/intermediate condition can be found in the same clump of plants (Crum & Anderson 1981). Determining sexuality in this species is difficult due to its small plant size; the Maine collection seems to be paroicous. The spores of *B. flexuosa* vary from spiculose to spiculose-reticulate, and the length and roughness of its leaf subulae are especially variable features of the species.

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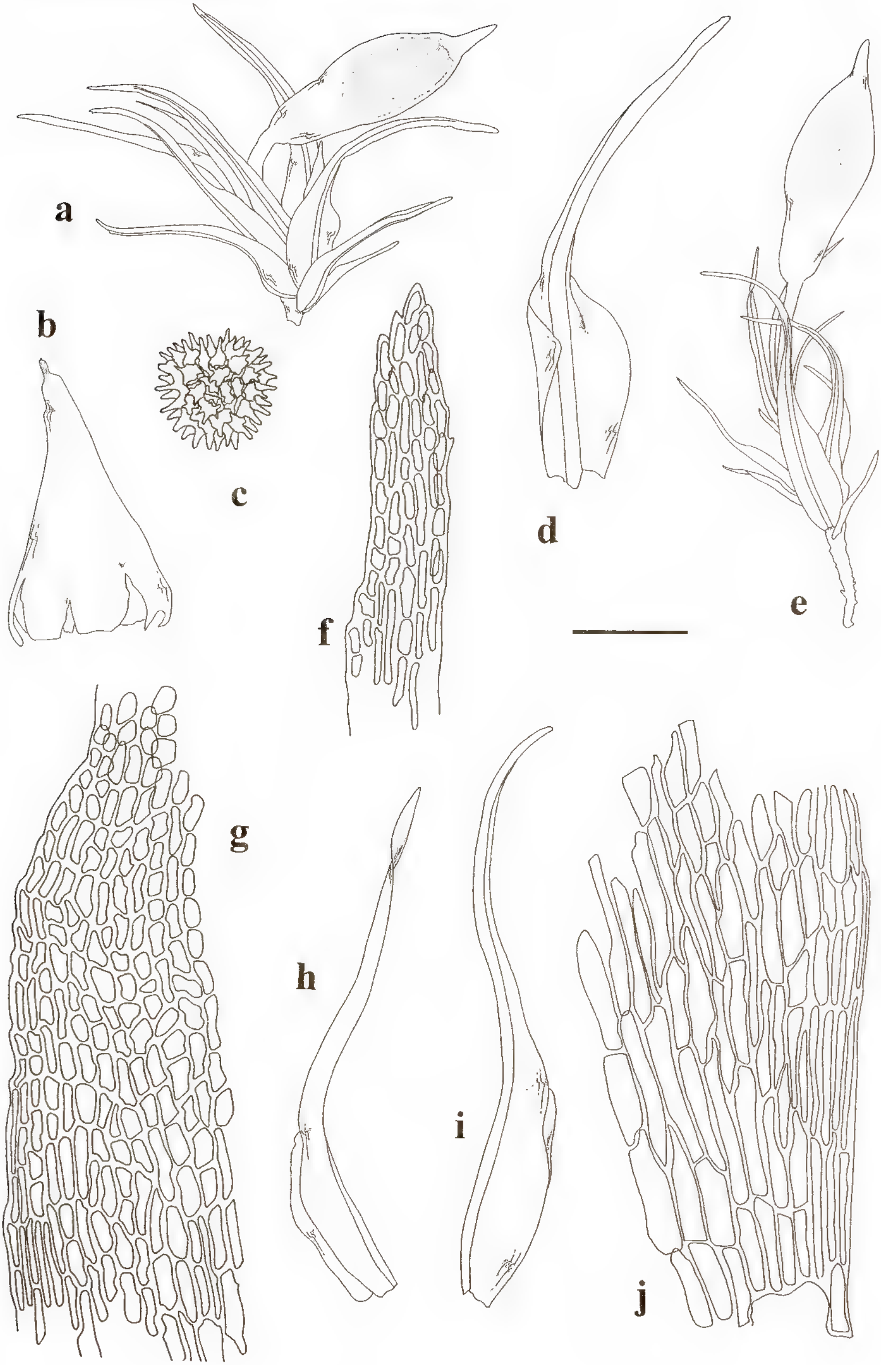
Figure 1. *Bruchia flexuosa.* a.& e. Habit. b. Calyptra. c. Spore. d., h. & i. Leaves. f. Leaf apex. g. Lower leaf cells and margin. j. Basal and alar region. Scale bar in mm: bar = 0.03 (c); bar = 0.05 (f,g,j); bar = 0.36 (b); bar = 0.5 (d,h,i); 0.9 (a,e). All figures from *Thaxter s.n.* (NEBC).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Acknowledgment. I wish to thank the curators of the bryophyte herbaria at NEBC and FH for access and loan of specimens used in this study.

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## The Liverwort Flora of Antarctica

H. BEDNAREK-OCHYRA, J. VANA, R. OCHRYA & R. I. LEWIS SMITH (2000): **The Liverwort Flora of Antarctica.** XVI + 236 + [2] pp., 96 figs. (including 18 colour photographs), 6 tables. Polish Academy of Sciences, Institute of Botany, Cracow. ISBN 83-85444-74-2. Price: 38.75 US$ (post included).

The Flora covers the whole of the Antarctic, i.e. all the land south of lat. 60°S including the South Sandwich Islands and the isolated island of Bouvetoya. The introductory chapters presenting topography, geology and climate, history of hepaticological exploration, the Antarctic vegetation and the geographical affinities of the hepatic flora are followed by a systematic treatment including keys to genera and species, illustrated descriptions of each of 27 species, taxonomic notes, local and global distributions maps and extensive citation of specimens and literature records. This is the first treatment of the hepatic flora of the Antarctic.

Other title still available.

R. OCHYRA (1998): **The Moss Flora of King George Island, Antarctica**. xvi + 278 pp. Polish Academy of Sciences, Institute of Botany, Cracow. The price of the book is 30.00 US$ (post included).

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# Bryophyte Records for Arkansas

**Piers Majestyk**[1]

**Abstract.** *New state and county distributional records of mosses and liverworts are given for 11 counties in Arkansas.* Syntrichia ruralis *is reported for the first time in the state and* Thuidium allenii *is confirmed for the state.*

A total of 83 county records, one of which is a state record, have been identified from 11 Arkansas counties. Voucher specimens of all species collected are deposited in the herbarium of Henderson State University (HEND) or in the author's personal herbarium. Nomenclature for the most part follows that of Anderson (1990) and Anderson et al. (1990). Nomenclature for the liverworts follows Stotler & Crandall-Stotler (1977). Crum & Anderson (1981) list *Thuidium allenii* as occurring within the state but voucher material could not be accounted for by the author. This paper confirms the presence of *Thuidium allenii* within the state. County names are in boldface and collection numbers are underlined for each record. For additional references concerning recent distributional records of Arkansas bryophytes consult Darigo (1998, 1999), Majestyk (1994, 1995, 2000), Redfearn (2000) & Timme (1997).

## MOSSES

AMBLYSTEGIACEAE
*Campylium chrysophyllum* (Brid.) J. Lange - **Bradley**: 2106; **Cleveland**: 2087.
ANOMODONTACEAE
*Anomodon rostratus* (Hedw.) Schimp. - **Ashley**: 2116.
AULACOMNIACEAE
*Aulacomnium heterostichum* (Hedw.) B.S.G. - **Grant**: 1884.
BRACHYTHECIACEAE
*Bryoandersonia illecebra* (Hedw.) Robins. -- **Grant**: 1875.
*Steerecleus serrulatus* (Hedw.) Robins. - **Drew**: 2144.
BRYACEAE
*Bryum capillare* Hedw. - **Hot Spring**: 2082.
*B. dichotomum* Hedw. - **Hot Spring**: 2068.
BRUCHIACEAE
*Trematodon longicollis* Michx. - **Lincoln**: 2154.
CRYPHAEACEAE
*Cryphaea glomerata* Bruch & Schimp. *ex* Sull. - **Ashley**: 2130; **Hempstead**: 1946.
DICRANACEAE
*Dicranella heteromalla* (Hedw.) Schimp. - **Ashley**: 2109.
DITRICHACEAE
*Ditrichum pallidum* (Hedw.) Hampe - **Ashley**: 2115; **Bradley**: 2102; **Cleveland**: 2090; **Drew**: 2149.

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[1] New York Botanical Garden, Bronx, NY 10458

ENTODONTACEAE
*Entodon macropodus* (Hedw.) C.Müll. - **Nevada**: 1929.
*E. seductrix* (Hedw.) C. Müll. - **Drew**: 2140; **Lincoln**: 2161.

FABRONIACEAE
*Clasmatodon parvulus* (Hampe) Hook. & Wils. - **Drew**: 2142; **Hempstead**: 1948; **Lincoln**: 2150.

FISSIDENTACEAE
*Fissidens bryoides* Hedw. - **Grant**: 1883.
*F. bushii* (Card. & Thér.) Card. & Thér. - **Hot Spring**: 2054.
*F. ravenellii* Sull. - **Grant**: 1877.
*F. subbasilaris* Hedw. - **Ashley**: 2137.

FONTINALACEAE
*Fontinalis novae-angliae* Sull. - **Grant**: 1912.

FUNARIACEAE
*Physcomitrium pyriforme* (Hedw.) Hampe - **Hot Spring**: 2052.5.

GRIMMIACEAE
*Schistidium rivulare* (Brid.) Podp. - **Hempstead**: 1950; **Lincoln**: 2157.

HYPNACEAE
*Hypnum lindbergii* Mitt. - **Washington**: 1852.5.
*Isopterygium tenerum* (Sw.) Mitt. - **Ashley**: 2117; **Drew**: 2139.

LEUCOBRYACEAE
*Leucobryum albidum* (Brid. *ex* P.-Beauv.) Lindb. - **Cleveland**: 2095.

LEUCODONTACEAE
*Leucodon julaceus* (Hedw.) Sull. - **Ashley**: 2129; **Lincoln**: 2151.

MNIACEAE
*Plagiomnium ciliare* (C. Müll.) T. Kop. - **Grant**: 1893.
*P. cuspidatum* (Hedw.) T. Kop. - **Hempstead**: 1961.

ORTHOTRICHACEAE
*Drummondia prorepens* (Hedw.) Britt. - **Hot Spring**: 2075.

POLYTRICHACEAE
*Atrichum angustatum* (Brid.) B.S.G. - **Ashley**: 2121; **Lincoln:** 2155.

POTTIACEAE
*Barbula unguiculata* Hedw. - **Hot Spring**: 2035.
*Syntrichia pagorum* (Milde) Amann - **Hempstead**: 1945.
*S. ruralis* (Hedw.) Web. - **Hot Spring**: 2079.
*Tortella humilis* (Hedw.) Jenn. - **Drew**: 2141.
*Weissia controversa* Hedw. - **Lincoln**: 2152.

SEMATOPHYLLACEAE
*Sematophyllum adnatum* (Michx.) E.G. Britt. - **Ashley**: 2120; **Drew**: 2145; **Grant**: 1904; **Nevada**: 1930.

SPHAGNACEAE
*Sphagnum lescurii* Sull. *in* Gray - **Grant**: 1909.

THELIACEAE
*Thelia hirtella* (Hedw.) Sull. - **Drew**: 2147; **Hempstead**: 1949; **Lincoln**: 2160.

THUIDIACEAE
*Thuidium allenii* Aust. - **Nevada**: 1928.
*T. delicatulum* (Hedw.) Schimp. - **Cleveland**: 2096; **Hempstead**: 1960; **Lincoln**: 2153.

**LIVERWORTS**

AYTONIACEAE

*Reboulia hemisphaerica* (L.) Raddi - **Hot Spring**: 2043.

CALYPOGEIACEAE

*Calypogeia meulleriana* (Schiffn.) K. Mull. - **Grant**: 1891.

CONOCEPHALACEAE

*Fossombronia foveolata* Lindb. - **Ashley**: 2126.

GEOCALYCACEAE

*Geocalyx graveolens* (Schrad.) Nees - **Grant**: 1882.

JUBULACEAE

*Frullania brittoniae* Evans - **Cleveland**: 2100; **Grant**: 1902; **Hot Spring**: 2042.
*F. eboracensis* Gott. - **Grant**: 1887; **Hot Spring**: 2075.5; **Nevada**: 1913; **Yell**: 1784.
*F. ericoides* (Nees) Mont. - **Drew**: 2146; **Hot Spring**: 1515.
*F. kunzei* Lehm. et Lindenb. - **Hot Spring**: 1564.5.

LEJEUNEACEAE

*Leucolejeunea clypeata* (Schwein.) Evans - **Ashley**: 2122.5; **Hot Spring**: 1465.
*L. unciloba* (Lindenb.) Evans - **Ashley**: 2135; **Drew**: 2138.

PALLAVICINIACEAE

*Pallavicinia lyellii* (Hook.) Carruth. - **Hot Spring**: 1466.

PORELLACEAE

*Porella pinnata* L. - **Nevada**: 1913.5.
*P. platyphylla* (L.) Pfeiff. - **Hot Spring**: 1498; **Nevada**: 1912.

RICCIACEAE

*Riccia huebenerian* subsp. *sullivantii* (Aust.) Schust. - **Drew**: 2143.

SCAPANIACEAE

*Scapania nemorosa* (L.) Dum. - **Cleveland**: 2099.
*S. undulata* (L.) Dum. - **Ashley**: 2114.

Acknowledgments. I thank Dr. Bill Buck, Dr. Paul Redfearn and Jimbo Bray for help in several identifications. I also thank Drs. William Reese, Howard Crum and Lewis Anderson for assistance in looking for *Thuidium allenii* voucher material.

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# Gemmae on Leaves and Other Observations Regarding *Bryum flaccidum* Brid.

**Virgil Martin**[1]

On a trip to the Bruce Peninsula, Ontario, during the summer of 1997, I collected some *Orthotrichum* on a roadside Sugar Maple (*Acer saccharum*). Under the dissecting microscope, my curiosity turned instead to a few very small, bright green plants hiding in a crevice. Despite a rather striking combination of characteristics, I was unable come to a satisfactory determination. I searched the manuals in vain for something combining broadly ovate leaves, a costa ending well short of a hyaline awn, entire and bordered margins, and gemmae on the leaves and in the axils. The gemmae were cylindrical and several cells in length and could be found scattered across both surfaces of some leaves, as well as in the leaf axils (Fig. 1). Eventually, I recognized that I was dealing with *Bryum capillare* Hedw. or something closely related to it. On comparing various manuals at hand, I was struck by the range of variation, the number of subordinate taxa and synonyms, and the often-contradictory characters attributed to this species. However, none of these references illustrates or describes gemmae on the leaves of this or any other *Bryum*. Nor did the small size of my specimens fit the range given for *B. capillare*. Most illustrations showed the costa extending into the tip, quite unlike my find. In most other respects, it matched reasonably well. By this time, I had returned to the site of my original collection and found more plants. I forwarded some of this material (533a, Nov. 1997, near Hepworth, Grey Co., ON: MICH) to Howard Crum at the University of Michigan. He confirmed the presence of the gemmae on the leaves and indicated that the specimen could be referred to either *Bryum flaccidum* Brid. or to *B. capillare* var. *flaccidum* (Brid.) Bruch. & Schimp *in* B.S.G. For the sake of brevity, I will employ the specific rank, although I harbor some misgivings as to its appropriateness. A few additional specimens have been deposited in the Wilfred Laurier University Herbarium (WLU) Waterloo, ON. Others remain in my collection. The *Atlas of Ontario Mosses* (Ireland and Ley, 1992) provides separate distribution maps for *B. capillare* and *B. capillare* var. *flaccidum,* the former being shown as fairly common and widespread across southern Ontario, whereas the latter is represented by just two collections, both from the southern margin of the Canadian Shield. The separate maps probably are not warranted, for, as Crum has stated: "Most, if not all collections from North America belong to the var. *flaccidum* (Brid.) BSG" (Crum 1983, p. 170). Thus, the apparent rarity of *B. flaccidum* in Ontario can probably be regarded as merely a nomenclatural artifact. In Ohio, the situation may be similar; Snider and Andreas (1996) show nine counties for *B. flaccidum* compared with 25 for *B. capillare,*

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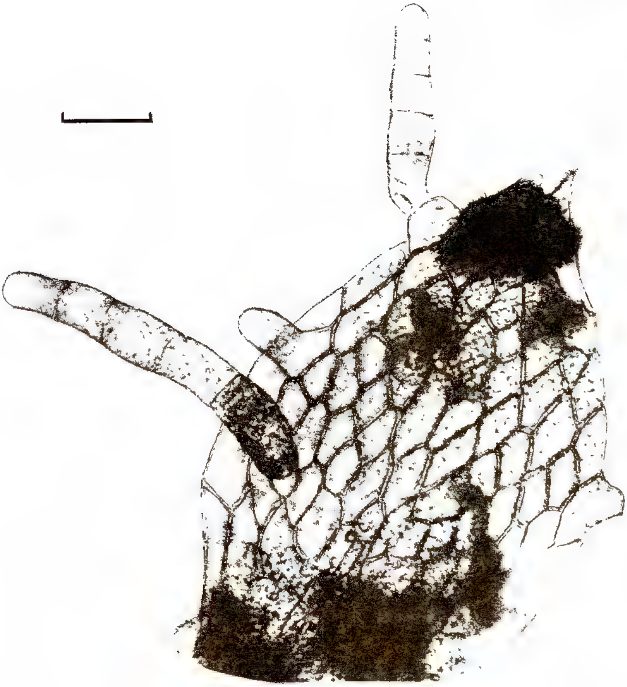

**Figure 1. Gemmae on a leaf .** This manually enhanced photograph shows gemmae at various stages of development. A single-celled initial is developing near the left margin. At the lower right, a base consisting of a slightly modified leaf cell is all that remains, while near the tip another gemma is about to detach. The dark blotches are lichen soredia. The scale bar represents approximately 50 microns.

with only one in common. Ketchledge (1980) chose to consolidate on *B. capillare* var.*flaccidum*, reporting it from 16 of 26 quadrangles covering New York State. No doubt, it is seriously under-collected and, therefore, under-reported throughout the Great Lakes region.

*Bryum flaccidum* is but one member of the cosmopolitan *B. capillare* complex. This problematic complex has received relatively little systematic attention, but was studied most extensively and most recently by Syed (1973). In his paper, he described a new segregate species (*B. laevifilum* Syed) closely related to *B. flaccidum.* Curiously, although he illustrated and annotated a gemma on a leaf of *B. laevifilum* (Fig. 2), nowhere in the text or key is any mention made of it (ibid., p. 294). Nor are gemmae on leaves mentioned in connection with any other species in Syed's paper. The only other reference I have found to gemmae on leaves of a *Bryum* is in regard to large, bright crimson tubers on upper leaves of *B. atrovirens* Brid. (Gangulee 1974-77, p. 986).

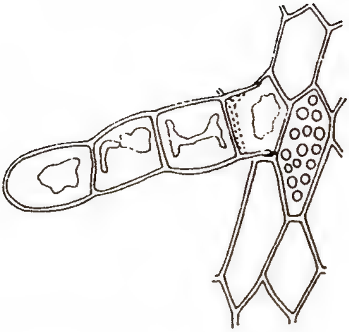

**Figure 2. Gemma on a leaf of *Bryum laevifilum* Syed.** (From Syed 1973, p. 294). Despite the special emphasis placed on the importance of gemmae for the identification of species in the *Bryum capillare* complex, no reference was made to this illustration in either the key or text. The drawing was evidently made from a specimen that had been thoroughly dried, judging by the congealed state of the cell contents.

The plants considered here seem to match *B. laevifilum* Syed, except for their smaller size and the gemmae and rhizoids being mostly papillose-roughened as opposed to more-or-less smooth (a character featured in Syed's key). The latter characteristic points to Syed's concept of *B. flaccidum,* but this fails in that there are no decurrencies, which he insists are present on the type specimen (ibid., p. 293). (It seems unlikely that he would have mistaken the long, narrow marginal cells for true decurrencies, although plucked leaves will sometimes separate from the stem in such a way as to appear decurrent.) He cited decurrent leaves as one of three critical characters that separate *B. flaccidum* from *B. capillare* (ibid., p. 293). If one subscribes to a "splitter" philosophy, it follows that the Ontario material should be differentiated from *B. flaccidum* at some taxonomic level, as it is quite non-decurrent. Syed recognized that *B. laevifilum* and *B. flaccidum* are closely related, having a similar distribution and ecology, but stated that he had "seen no intermediates between them" (ibid., p. 297). The material under consideration here, would seem to be such. Another possible fit within Syed's scheme might be with a single Japanese specimen that he speculated might be a hybrid (ibid., p. 292). The hybrid hypothesis hardly seems plausible here for various reasons, most notably the wide distribution of occurrences and apparent absence of potential parents. An alternative (if not very satisfying) interpretation would be that the plants discussed here are just another expression of the inherent variability of a complex that may not be amenable to satisfactory classification at the specific level.

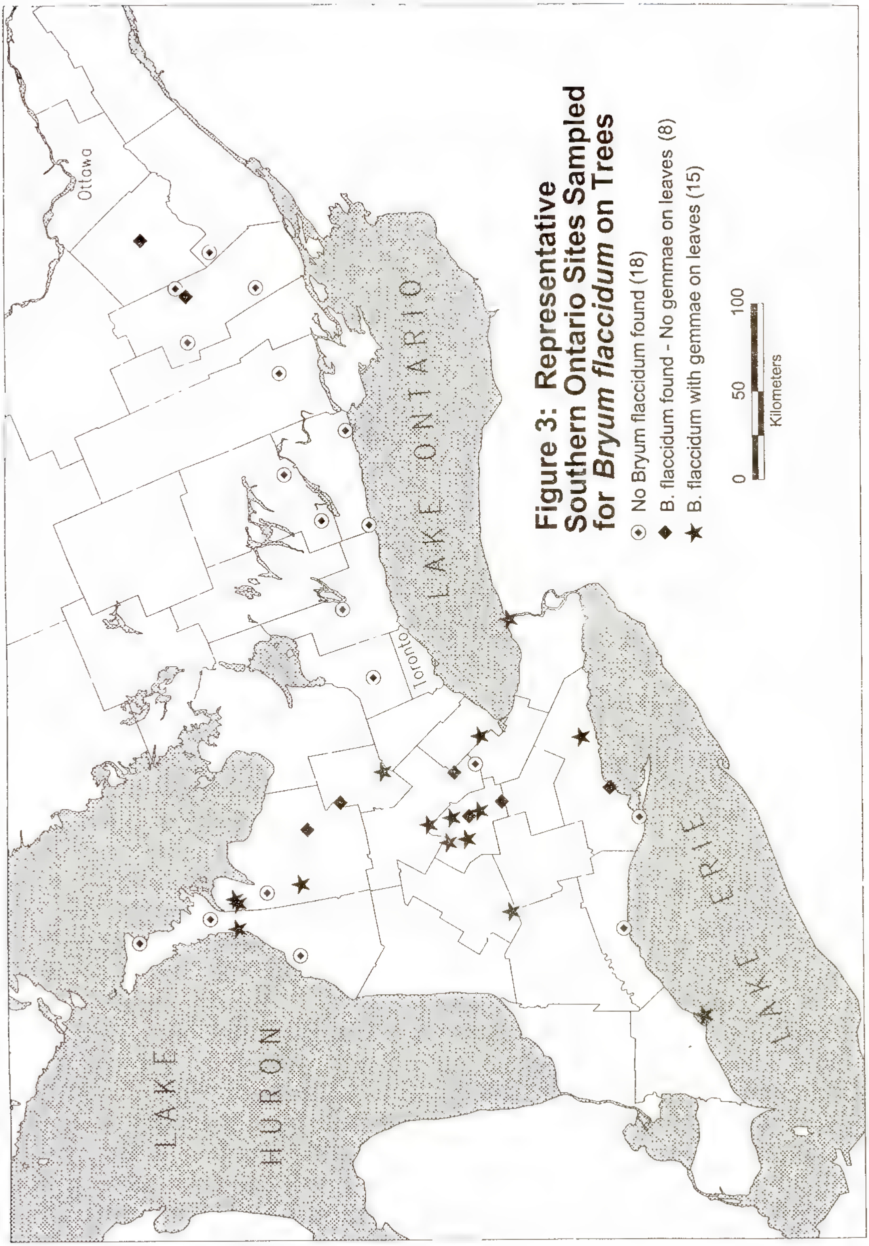

Figure 3: Representative Southern Ontario Sites Sampled for *Bryum flaccidum* on Trees

⊙ No Bryum flaccidum found (18)
◆ B. flaccidum found - No gemmae on leaves (8)
★ B. flaccidum with gemmae on leaves (15)
0
50
100
Kilometers
Ottawa
Toronto
LAKE ONTARIO
LAKE HURON
LAKE ERIE

Since the initial discovery, I have collected *Bryum flaccidum* on the bark of mature open-grown hardwoods from across southern Ontario (Fig. 3). *B. flaccidum* is frequent, though seldom abundant, on open-grown hardwoods in southwestern Ontario, but seems to be much less common in eastern Ontario. The cluster around Waterloo Region (west of Toronto) on figure 3 reflects a higher rate of sampling; sites where *B. flaccidum* was not found are not shown on the map. My approach has been to gather several dozen readily-detached mossy bark fragments at each site and then to inspect them closely under the dissecting microscope. *Bryum flaccidum* seems to be locally common in southwestern Ontario, though almost invariably subordinate to more robust species. It may be less drought tolerant than some other species, being usually restricted to the shelter of grooves or projections of bark, most often near the base but also well up on the trunk. Recently, I have also been finding it on the bases of Eastern White Cedar (*Arbor vitae*) where it may well be more frequent than on hardwoods. I have found similar plants on soil and limestone, but have put much less effort into collecting from these substrates. These plants seem never to have gemmae on the leaves, although they are sparingly present in the axils. In several collections from limestone erratics, the plants seem indistinguishable from corticolous occurrences except for their significantly larger size (the leaves reaching 2 mm in length or twice that of typical epiphytes) and the absence of gemmae on the leaves.

It would make an interesting and useful experiment to culture these plants on artificial media or transplant them between bark and soil or rock to see whether the size difference and the occurrence of leaf gemmae can be attributed to the substrate. If these characters were controlled by the growth medium, they would be of no taxonomic significance. If, on the other hand, these characters persist, they would seem to be genetically governed and a distinct specific status would seem justified.

In nearly every instance where I found more than a few plants on bark, gemmae were present on some leaves. On some mature plants, particularly where leaves have been damaged, gemmae are sometimes abundant to the point of obscuring the leaf surfaces. In such instances, they can be quite elongated and much branched. The gemmae are easily detached, seem to be somewhat sticky, and no doubt serve as an effective dispersal mechanism. Their fragility may also help to explain why they have not been previously reported for *Bryum*. Another reason may be that the vast majority of collections of the *B. capillare* complex are non-corticolous. A search of the New York Botanical Garden's on-line catalog (NYBG 2000) revealed 58 (of 79) collections with habitat data; of these, only four are from trees, and these only from bases or roots.

My investigation of *B. flaccidum* has thus far focused on fresh material, and particularly on the gemmiferous habits of this moss. There appear to be some fairly discrete variations in the morphology of the gemmae, but only the axillary type and the so-called "tubers" have received attention in the literature (Whitehouse 1963, 1966, Crundwell and Nyholm 1964, Syed 1973, Crum 1983). Table 1 summarizes my observations; the various types noted here seem to be reasonably distinct, but some may be only weakly, or not at all, differentiated physiologically.

**Table 1. Types of Gemmae Found on *Bryum flaccidum***

1. **Typical cylindrical ("filamentous") gemmae:**

Traditionally described as "filamentous," to me, they seem too stout; it seems more appropriate to describe them as "cylindrical." Regardless of their position, cylindrical gemmae are thin-walled, more-or-less smooth and pellucid when young, becoming roughened and more opaque with age. Predominantly green at maturity, there is often some brown coloration present even in young cells and they eventually become predominantly brown. Bacteria are invariably present in senescent or damaged cells.

**In the axils**: found on most plants, but not in all axils; (18)22 - 26(35) microns in diameter and to 150 or more in length; mostly simple but occasionally branching dendritically;

**On lamina**: similar to 'a' above, but averaging somewhat smaller, (smoother?) and more readily deciduous (Figs. 1 and 2);

**On rhizoids**: occasionally arising from rhizoids where these emerge into light; always straight, erect, but not noticeably different in form from other cylindrical gemmae.

2. **Miniature cylindrical gemmae:**

Although much less frequent than typical gemmae, distinctive "miniature" gemmae with an average width of only 8-10 microns were found. These miniatures were noted in axils as well as on leaves. They were either colorless or with a single chloroplast per cell and more-or-less papillose-roughened. While it may seem easy to dismiss them as merely immature or under-developed variants, they were invariably mixed with and sometimes just as long as their stouter kin. Also, many gemma initials were seen (having a length of one or two cells), but these already had attained more-or-less the diameter of typical gemmae. I have seen very few intermediates (in the range of 12 - 18 microns). These miniature gemmae seem intermediate between typical cylindrical gemmae and protonemata at least in their general morphology.

3. **Tuberous (rhizoidal) gemmae:**

Tubers were almost entirely ignored or overlooked by bryologists until 1960's when a series of papers demonstrated their potential usefulness for taxonomic purposes (Whitehouse 1963, 1966; Crundwell and Nyholm 1964). Although I have not been as systematic in searching them out as with gemmae on the leaves, I have found them occasionally. Spherical, oval or irregular, multi-cellular tubers, mostly 50 - 60 microns, but a few considerably larger (two or more fused?), dark red-brown to black, the cells papillose-roughened but mostly not protuberant, found in narrow cavities between layers of bark.

Although Whitehouse (1966) demonstrated the reproductive capability of such tubers by culturing them, their situation would seem to make them an inefficient dispersal mechanism, suggesting that their main function is primarily a means of surviving unfavorable conditions.

4. **"Pseudo gemmae":**

**Swelling and distortion of rhizoids:** occasionally on the rhizoids are found irregularly-shaped and usually angular swellings involving one or two cells, usually at some mid-point on the rhizoid and, though sometimes at the end, not on a short branch as in typical tubers. Although unlike typical tubers, they may serve a similar purpose; or they may have no special function if, in fact, they are produced in response to some external stimulus.

**Gelatinous masses:** frequently there are extensive patches of gelatinous material associated with patches of *B. flaccidum.* It is not at all certain that this material is part of the moss, but may rather be algae. Whatever the explanation, the association is a very strong and apparently exclusive, and its appearance (when moist) is sufficiently like an amorphous mat of tubers to warrant mention here. Rhizoids often run through the material, but I have not yet been able to determine the nature of the connection with it.

It has already been noted that the plants bearing leaf gemmae are small. In fact, the largest are under 5 mm in height and typically about 3 mm. European descriptions for *B. flaccidum* and *B. capillare* typically give 10 - 50 mm as the range of heights, whereas North American authors cite less than 10 mm as typical. Regarding the length of the leaves, there is somewhat better agreement; for example, Syed (1973) cites 1.4 - 4.0 mm for *B. flaccidum* as compared with 1.5 - 3.0 mm given by Crum and Anderson (1981). My epiphytic collections range in height from approximately 2 - 5 mm and leaf length 0.5 - 1.5 mm with 0.9 being typical. Is this consistent and substantial size difference attributable to environmental conditions alone?

Evidence of sexual reproduction has been limited to only a few collections. Sporophytes were found in abundance in one collection (606 Sudden Tract, Waterloo Region, Oct. 4, 1998); curiously, these plants were significantly larger than any others collected from bark. In another collection, well-developed antheridia were evident (598 on mud flats, Woolwich Reservoir, Waterloo Region, Sept 5, 1998). Occasional archegonia have also been seen. The majority of collections show no evidence of sexual reproduction, and it seems safe to conclude that in its corticolous habitat at least, *B. flaccidum* relies primarily on gemmae for dispersal.

In a dry condition, the leaves of *Bryum flaccidum* are typically somewhat contorted and spirally-twisted around the central axis of the plant. In this state, the costa is rather prominent and whitish on the abaxil surface. The plants bear a superficial resemblance to a *Mnium*, but are much smaller, and lack the stoloniferous habit and serrate leaves. Gemmae on the leaves or in the axils often remain obscure until moisture causes the leaves to spread. With a little familiarity and at least 15X magnification, the moss is identifiable in both dry and moist conditions in the field.

Costa length is extremely variable, from only a few cells at the base, to just short of the apex. I have not found the costa running into the tip in any of hundreds of leaves examined, although this condition is frequently attributed to *B. capillare* complex. Typically, it is about 2/3 the length of the leaf. Costa length, border distinctiveness, concavity of leaves, degree of spiraling around stem, and reddish-brown color of leaves are all more-or-less positively correlated with size and apparent age of the plants. Other factors, however, also come into play. The neat spiraling of leaves around the central axis of the plant, for example, is most pronounced when drying happens very slowly; sudden drying causes less regular contortions of the leaves. None of the characters noted here can be considered reliable for taxonomic purposes, though many of them, unfortunately, have been used to construct diagnostic keys.

In summary, specimens of the *Bryum capillare* complex collected from the bark of hardwoods in southern Ontario differ from others described in the literature. The common occurrence of gemmae on the leaves is striking and newly reported here. The small size of the plants falls outside reported values for the complex, although the significance of this is difficult to assess without further study. Variability in the degree of roughness of gemmae and rhizoids within individual plants cautions against reliance on this character for taxonomic discriminations. Finally, the lack of decurrencies together with the small size of the plants and leaves suggest that this material cannot be strictly equated to *Bryum flaccidum* Brid. Until the *B. capillare* complex receives careful systematic attention across its cosmopolitan range, it seems prudent to avoid jumping to conclusions about the taxonomic significance of these distinctions. Nevertheless, the consistency of the characters reported and their occurrence across a fairly broad geographical area suggests that some level of segregation may be warranted. Experimental culturing of the plants from various substrates could help separate environmental and genetic influences, and thereby clarify the status of *B. flaccidum* in southern Ontario.

**Acknowledgements**: I wish to thank Howard Crum for suggesting this article and reviewing an earlier draft of it. His encouragement and assistance have been invaluable. Tony Szumigalski and Carla Zelmer, University of Guelph, provided both field and laboratory assistance and encouragement.

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The deadline for the submission of abstracts was March 9, 2001. All ABLS members should have received a Call for Papers. A later circular will be mailed (in spring 2001) about registration, housing, etc.

I look forward to seeing many of you in New Mexico in August.

Bill Buck
ABLS Program Chairman

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# EVANSIA

Volume 18 Number 2

The genus *Cynodontium* (Musci: Dicranaceae) in Maine
Bruce Allen 41

Additions to the Lichen of the Huron Mountain Club
William R. Manierre 51

Bryophytes of the Interior Highlands of North America: *Ephemerum serratum and Phaeoceros oreganus* New to Interior Highlands and Missouri, *Grimmia longirostris* New to Oklahoma, plus Other County Records
Carl E. Darigo 53

A second locality for *Xanthoparmelia idahoensis* Hale, an endangered vagrant lichen, new to Canada
Bernard Goffinet, Roger Rosentreter & Emmanuël Sérusiaux 58

*Bryum alpinum* and *Grimmia donniana*, New to Michigan
William R. Manierre 60

A *Brachythecium* of Michigan Worthy of Note
Howard Crum 62

Bryophyte Records for Arkansas II
Piers Majestyk 63

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# The genus *Cynodontium* (Musci: Dicranaceae) in Maine

**Bruce Allen** [1]

*Cynodontium* Bruch & Schimp. *ex* Schimp. is a genus of 15 species (Crosby *et al.* 2000) found primarily in the northern hemisphere. It typically occurs in tufts over thin soil in crevices of boulders, on vertical rock faces, or in the recesses of overhanging rocks and ledges. The genus is autoicous and collections with sporophytes are commonly encountered. The sporophytes of *Cynodontium* are more or less typical for the Dicranaceae, the only sporophytic features helpful in recognizing the species in the field are its furrowed capsules and, in one of our species, strumose capsule necks. The genus does, however, exhibit remarkable variabity in its peristome and annulus. Although the peristome teeth in *Cynodontium* are generally forked the divisions can be unequal and quite variable, at times the teeth are entire. The annulus in *Cynodontium* is variable in a manner similar to that seen in *Dicranella* (C. Müll.) Schimp. *sensu lato*; it can be rudimentary and more or less adherent to the capsule mouth or it can be complex, compound and revoluble. The cladoautoicous sexual condition of *Cynodontium* – with the perigonia found just below the perichaetia – and the presence of rhizoidal initials on both the stems and leaves are noteworthy features of the genus. In addition, its keeled leaves with recurved, bistatose to tristratose margins, coarsely unipapillose to mammillose leaf cells, and very weak alar cell differentiation make the genus distinctive.

*Cnestrum* Hag. is a segregate of *Cynodontium* (see Nyholm 1987, Abramov & Volkova 1998) that Brotherus (1924) restricted to a single species (*C. schistii* (Web. & Mohr) Hag.) characterized by undivided peristome teeth and mammillose leaf cells. Nyholm (1987) expanded the genus to include several species marked by perigonia borne on short stalks, a weakly developed annulus, oval capsules with stomata, and both divided or entire peristome teeth. Of these, the only features that separate *Cnestrum* from *Cynodontium* are the oval capsules and stalked perigonia. I agree with Crum & Anderson (1981) in considering the character state "stalked perigonia" unworthy of generic importance and since *Cynodontium* can have ovate capsules that closely approach those of *Cnestrum* I consider the two synonymous.

The systematic position of *Cynodontium* is not easy to determine because while it has a number of odd features, overall it is more or less typical for the Dicranaceae. The genus has been associated with *Oncophorus* (Brid.) Brid. (Grout 1937), both genera are autoicous and share the features of recurved, bistratose leaf margins, weakly developed alar cells, and furrowed, strumose capsules. *Oncophorus* differs from *Cynodontium* in having smooth leaf cells, and sheathing leaf bases. The Maine species of *Cynodontium* also differ from *Oncophorus* in having one rather than two costal stereid bands, but some European species of *Cynodontium* apparently have two costal stereid bands (see Nyholm 1987). The two genera also occupy mostly different habitats, with *Oncophorus* often found on rotting wood. There is one species of *Oncophorus* (*O. raui* (Aust.) Grout) that like *Cynodontium* occurs on thin soil over acidic rocks and cliffs.

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Limpricht (1886) placed *Cynodontium* (along with *Dichodontium, Oreas*, *Oreoweisia*, and *Rhabdoweisia*) in the Rhabdoweisiaceae as did Fleischer (1923). Walther (1983) continued the association of *Cynodontium* with *Rhabdoweisia* in placing the genus in the Dicranaceae subfam. Rhadoweisioideae. This association has more recently been advocated at the family level by LaFarge *et al.* 2000 and Buck & Goffinet (2000) on the basis of molecular evidence with extremely low support indices (bootstrap value = 60, decay index = 3). The Rhabdoweisiaceae as they consititute it represents a family of small acrocarpous mosses with weak alar cell development. Otherwise nearly every conceivable morphological variation exhibited by acrocarpous mosses can be found in the family. The single character cited by Buck & Goffinet (2000) that could serve to unite the family – stem lacking central strand – is not a consistent feature of the family since *Cynodontium* has a stem central strand.

Brotherus (1924) treated the genus in the Dicranaceae subfam. Dicranoideae near a group of species characterized by weakly differentiated alar cells, and mammillose leaf cells. I agree with Brotherus's placement of the genus in subfam. Dicranoideae, but would place *Cynodontium* close to the *Dicranum/Orthodicranum* complex. Certainly the peculiar cladoautoicous condition of *Cynodontium* is not found in that complex, but such odd features as its small size, crispate habit, weakly developed alar cells, and papillose leaf cells are found in *Orthodicranum montanum* (Hedw.) Loeske. Furthermore, most if not all of of its other sporophytic and gametophytic characters are found within members of that complex.

The name *Cynodontium* combines the Greek *kynos* (dog) with *odontos* (tooth), and refers to the peristome teeth of the genus.

*Cynodontium* Bruch & Schimp. *ex* Schimp., Coroll. Bryol. Eur. 12. 1856.
*Cnestrum* Hag., Kongel. Norske Vidensk. Selsk. Skr. 1910 (3): 23. 1915.

Plants small, in dense dark-green or yellowish green tufts. Stems branching irregularly by subperichaetial branches, sclerodermis and central strand present; rhizoids moderate to dense, originating from stem and basal leaf cell initials, hyaline to light reddish brown. Upper leaves crispate, curled-contorted when dry, erect-flexuose from an erect base when wet, lanceolate to narrowly lanceolate, concave below, keeled and channeled along the costa above, gradually acuminate, acute to bluntly acute; margins entire at base, serrulate to serrate above, variously recurved from near the base to near the apex, bistratose often mutistratose near apex; costa subpercurrent, in cross-section with somewhat enlarged ventral surface cells, single row of guide cells, and dorsal stereid cells; upper cells subrectangular, subquadrate, quadrate, oblate, or triangular, firm-walled, irregularly but strongly papillose to mammillose, basal cells short- to long-rectangular, thin- or firm-walled, alar cells weakly differentiated, light reddish brown. Autoicous. Perigonia sessile or stalked, just below the perichaetia; perigonia leaves saccate at base; perichaetial leaves enlarged, somewhat sheathing. Setae erect. Capsules erect or curved, oblong to oblong-cylindric,variously furrrowed, struma present or absent; stomata in capsule neck; annuli revoluble or rudimentary and persistent. Opercula conic-rostrate. Peristome teeth 16, attached on a short, smooth basal membrane, papillose with thick vertical striate on dorsal (outer) surface, ventral (inner)surface smooth, thin, dorsal and ventral trabeculae weakly thickened. Spores lightly papillose. Calyptrae cucullate, smooth.

Capsules curved, inclined, strumose; annulus revoluble; outer perigonial bracts acute or bluntly pointed; rhizoids numerous, from stem and leaf initials ........................................................................................ *C. strumiferum*
Capsules straight, erect, not strumose; annulus rudimentary and persistent; outer perigonal bracts rounded or rounded obtuse; rhizoids sparse, from stem initials ........................................................................ *C. tenellum*

1. *Cynodontium strumiferum* (Hedw.) Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 21: 230. 1864. *Fissidens strumifer* Hedw., Sp. Musc. Frond. 160. 1801. *Oncophorus strumifer* (Hedw.) Brid., Bryol. Univ. 1: 395. 1826. *Cynodontium polycarpum* var. *strumiferum* (Hedw.) Schimp., Coroll. Bryol. Eur. 12. 1856. *Oncophorus polycarpus* var. *strumiferus* (Hedw.) Grout, Moss Fl. N. Amer. 1(2): 67. 1937.

Plants small in dense, dark-green or yellowish green tufts. Stems 10–20 mm tall, branching irregularly by subperichaetial branches, sclerodermis and central strand present; rhizoids moderate to dense, originating from initials on stem and basal leaf cells, hyaline to light reddish-brown, densely branched. Upper leaves 2–4.5 mm long, crispate, curled-contorted when dry, erect-flexuose from an erect base when wet, lanceolate, concave below, keeled and channeled along the costa above, gradually acuminate, acute; margins entire at base, serrulate to serrate above, variously recurved from near the base to near the apex, bistratose, often mutistratose near apex; costa subpercurrent, in cross-section with somewhat enlarged ventral surface cells, single row of guide cells, and dorsal stereid cells; upper cells subrectangular, subquadrate, quadrate, oblate, or triangular, in more or less distinct rows, firm-walled, 4–22 x 18–20 µm, irregularly but strongly papillose to mammillose, basal cells short- to long-rectangular, firm-walled, 12–50 x 6–12 µm, alar cells weakly differentiated, light reddish brown. Autoicous. Perigonia bud-like, with 3–4 leaves, sessile just below the perichaetum, outer perigonial leaves enlarged, acute, innermost perigonial leaves reduced, obtuse to broadly obtuse; perichaetial leaves enlarged, somewhat sheathing. Setae erect, 5–7 mm long, yellow, becoming reddish-brown with age. Capsules curved, asymmetrical, inclined, oblong-cylindric, 1.5–2 mm long, strongly furrowed, distinctly strumose; stomata in capsule neck; annuli revoluble. Opercula conic-rostrate, 1.0 mm long. Peristome of 16 teeth, attached above the capsule mouth on a short, smooth basal membrane, dark-red, papillose with thick vertical striate on dorsal (outer) surface, ventral (inner) surface smooth, dorsal and ventral trabeculae weakly thickened. Spores lightly papillose, 16–22 µm. Calyptrae 2–2.5 mm long, cucullate, smooth. n = 11, 14, 15 (Fritsch 1991).

On soil in rock crevices and underneath rock overhangs. In Maine known from Oxford (*Allen 22212* MO), Somerset (*Allen 22662* DUKE, MAINE, MO, NY, US), and Piscataquis (*Lowe s.n.* NY) Counties.

*Cynodontium strumiferum* can be immediately distinguish from *C. tenellum* on the basis of its asymmetric and strumose capsules. In addition, the revoluble annulus of *C. strumiferum* is an easily seen microscopic feature that is distinctly different from the rudimentary, persistent annulus of *C. tenellum*. When sporophytes are absent, however, the two species are difficult to tell apart. Crum & Anderson (1981) and Ireland (1982) emphasize the broader perigonial leaf apices of *C. tenellum* as a distinguishing feature of the species. Although this distinction will usually separate the two species, the feature needs to be carefully evaluated because while the outer perigonial leaves of *C. strumiferum* are acute, the innermost perigonial leaves closely approach those of *C. tenellum*. Those familiar with both species can also distinguish *C. strumiferum* from *C. tenellum* by its longer, broader leaves that are more spreading from the leaf insertion, more sharply serrate, and not nearly as contorted when dry as those of *C. tenellum*.

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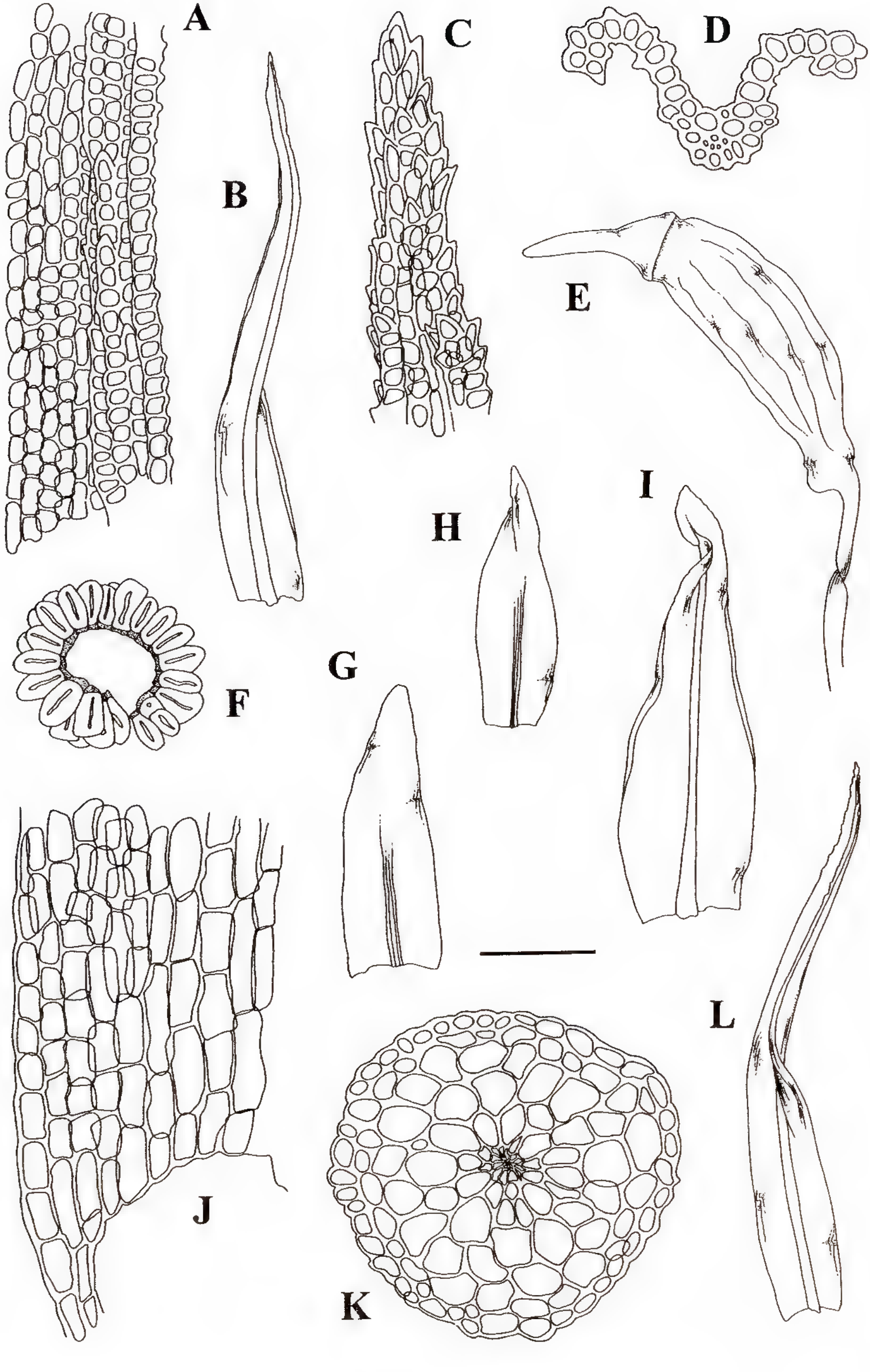
Figure 1. *Cynodontium strumiferum*. A. Upper leaf cells and margin. B. & L. Leaves. C. Leaf apex. D. Leaf cross-section. E. Capsule and operculum. F. Annulus. G. & H. Inner perigonial leaves. I. Outer perigonia leaf. J. Basal leaf cells and margin. K. Stem cross-section. Scale in mm: bar = 0.05 (A,C,D,J); bar = 0.06 (K); bar = 0.1 (F); bar = 0.36 (G–I); bar = 0.6 (B,E, L). All figures from *Allen 22662* (MO).


A
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There are also other subtle differences between the species. Plants of *C. strumiferum* tend to have more rhizoids than plants of *C. tenellum* and they originate from both stem and leaf initials. In *C. tenellum* the rhizoids apparently occur only on the stems. Finally, the perigonia in *C. strumiferum* are often difficult to find and always consist of 3–4 perigonial leaves while *C. tenellum* has abundant, rudimentary perigonia that consist of only 1–2 perigonial leaves.

2. *Cynodontium tenellum* (Schimp.) Limpr., Krypt.-Fl. Schlesien 1: 425. 1877.
*Cynodontium polycarpum* var. *tenellum* Schimp., Syn. Musc. Eur. (ed. 2) 63. 1876.

Plants small in dense, dark-green, yellowish green tufts. Stems 10–25 mm tall, branching irregularly by subperichaetial branches, sclerodermis and central strand present; rhizoids moderately to thickly developed, originating from stem initials, mostly hyaline. Upper leaves 2–3 mm long, crispate, curled to spirally contorted when dry, erect-flexuose from an erect base when wet, narrowly lanceolate, concave below, keeled and channeled along the costa above, gradually acuminate, acute or bluntly acute; margins erect and entire at base, serrulate above, recurved from above the erect base to near the apex, bistratose, often tristratose near apex; costa subpercurrent, in cross-section with somewhat enlarged ventral surface cells, single row of guide cells, and dorsal stereid cells; upper cells subquadrate, quadrate, or oblate, firm-walled, 4–12 µm, irregularly papillose to mammillose, basal cells short- to long-rectangular, thin- or firm-walled, 18–70 x 5–12 µm, alar cells weakly differentiated, red. Autoicous. Perigonia rudimentary, with 1–2 perigonial leaves, sessile just below the perichaetia, antheridia in the axil of one or between two perigonial leaves that are rounded-obtuse above and saccate below; perichaetial leaves enlarged, somewhat sheathing. Setae erect, 5–6 mm long, yellow, becoming reddish with age. Capsules erect, symmetrical, oblong to oblong-cylindric, 1 mm long, moderately furrowed; stomata in capsule neck; annuli rudimentary, adhering to capsule mouth after dehiscence. Opercula conic-rostrate, 0.5–1.0 mm long. Peristome of 16 teeth, attached at the capsule mouth on a low, smooth basal membrane, dark-red, papillose with thick vertical striate on dorsal (outer) surface, ventral (inner) surface smooth, dorsal and ventral trabeculae weakly thickened. Spores lightly roughened, 16–20 µm. Calyptrae 2 mm long, cucullate, smooth. n = 14 (Fritsch 1991).

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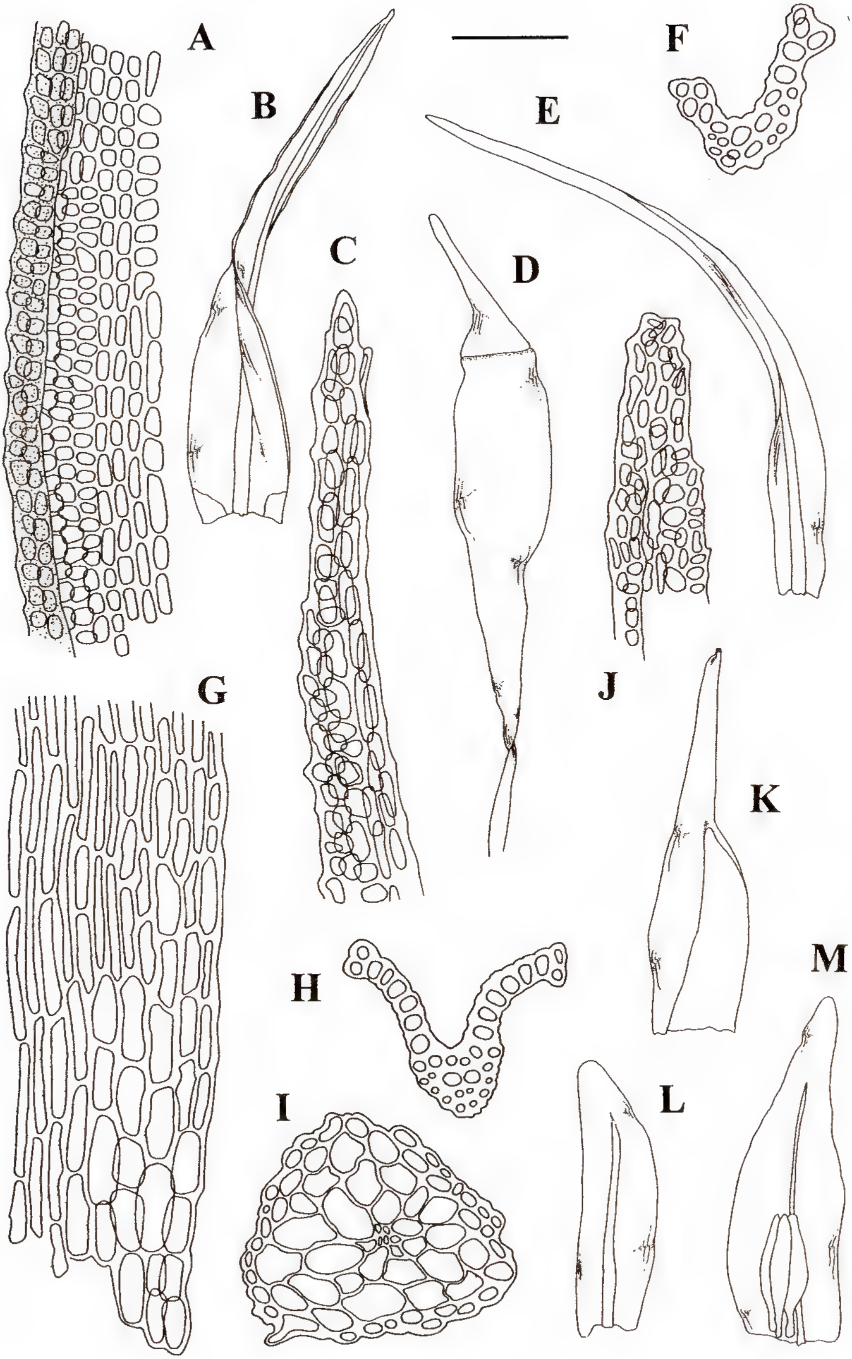
Figure 2. *Cynodontium tenellum.* A. Upper leaf cells and margin. B. & E. Leaves. C. & J. Leaf apices. D. Capsule and operculum. F. Upper leaf cross-section. G. Basal leaf cells and margin. H. Median leaf cross-section. I. Stem cross-section. K. Calyptra. L. & M. Perigonia leaves. Scale in mm: bar = 0.05 (A,C,F–J); bar = 0.36 (L,M); bar = 0.4 (B,E); bar = 0.5 (D); bar = 0.6 (K). Figures A, C–M from *Allen 15865* (MO); figure B from *Collins 1491* (NY).


A
B
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On acidic soil over vertical outcrops and rock ledges. In Maine known from Cumberland (*Allen 5999* MO), Franklin (*Allen 15846* MO), Oxford (*Allen 22579* DUKE, MAINE, MO, NY, US), Somerset (*Collins 1491* NY), and Washington (*Norton s.n.* MAINE) Counties.

*Cynodontium tenellum* is a small, usually dark-green moss with leaves that are strongly crispate when dry. The species is usually collected on thin soil in the crevices of boulders, and recesses of vertical rock faces. In size and aspect (especially in their strongly crispate leaves) *C. tenellum* is similar to *Orthodicranum montanum* or *Oncophorus wahlenbergii* Brid. The latter species is also similiar to *C. tenellum* in having recurved, bistratose leaf margins and both species are autoicous. *Oncophorus wahlenbergii* usually occurs on rotting wood. It further differs from *C. tenellum* in having strongly clasping leaf bases, smooth leaf cells and strongly curved, asymmetrical, strumose capsules. *Orthodicranum montanum* and *C. tenellum* have erect, non-strumose capsules and while those of *C. tenellum* are moderately furrowed the capsules of *O. montanum* are smooth to lightly and irregularly furrowed. The two species are also similar in having papillose leaf cells. *Orthodicranum montanum* is a dioicous species and it further differs from *C. tenellum* in having erect, unistratose leaf margins. Another more subtle difference between the two species is found in the dry aspect of their plants. As noted above both plants have leaves crispate-contorted when dry, in *O. montanum* however the leaves are tubulose when dry which gives them a firm aspect. In contrast the leaves of *C. tenellum* are folded along their keels when dry resulting in a more open, fragile aspect. This aspect is somewhat similar to that of the dry leaves in *Rhabdoweisia crispata* (With.) Lindb. which differs from *C. tenellum* in having broader oblong-lanceolate to lanceolate leaves, smooth leaf cells, shorter setae (2–4 mm), and rudimentary, peristome teeth.

This species has usually been treated in eastern North America as *Cynodontium alpestre* (Crum & Anderson 1981, Ireland 1982, Allen 1999). Mogensen (1980) discussed the complex nomenclature of this taxon and demonstrated the name is properly applied to a more northernly distributed moss characterized by obtuse to bluntly rounded leaves with strongly mammillose leaf cells. The association of the epithet *alpestre* with our species is due to the erroneous inclusion by Bruch & Schimper (1847) of *Dicranum alpestre* Wahlenb. in the synonomy of *Dicranum gracilescens* var. *tenellum*. This error, noted by Schimper (1876) and Limpricht (1877), was discussed in detail by Mogensen (1980). Unfortunately an earlier treatment of *D. alpestre* at the varietal level (as *Dicranum gracilescens* var. *alpestre* Hüb., 1833) makes the epithet *tenellum* as treated by Bruch & Schimper (1847) illegitimate. The next use of the epithet *tenellum* for our species appears to be Schimper's (1876) *Cynodontium polycarpum* var. *tenellum* and this can be treated as a *nomen novum* for *Dicranum gracilescens* var. *tenellum* (see Art. 58, The International Code of Botanical Nomeclature, Greuter *et al.* 2000), thus becoming the basionym of *Cynodontium tenellum.*

The nomenclatural tangle surrounding *C. tenellum*, however, has not been completely unraveled since Crundwell (1971) pointed out that the oldest basionym for this species may be *Dicranum tenellum* Pöch. This name appeared on No. 45 in Pöch's Musci Bohemici (1846, see Sayre 1971), an exsiccata that was not widely distributed. Müller (1851) considered this name synonymous with *Dicranum polycarpum* var. *tenellum*. I have not seen this Pöch specimen (neither did Crundwell 1971 nor Mogensen 1980) or the schedae in which the name appeared. Whether the name was validly published and whether Pöch's No. 45 is the same as *Cynodontium polycarpum* var. *tenellum* Schimp. remains unknown.

Excluded species.

*Cynodontium polycarpon* (Hedw.) Schimp. has been reported by Rand & Redfield (1894) from Hancock County [On decayed wood. Wood road to Great Pond, Southwest Harbor, *Rand*]. I have been unable to find this collection at NEBC, but it seems unlikely that it is properly named since it was collected on rotten wood. There are several collections of *Oncophorus wahlenbergii* in NEBC from the same locality, and it may be that this report also is *O. wahlenbergii.*

*Cynodontium schistii* has been reported from Piscataquis (Allen 1991) and Oxford (Allen 2000) counties. The Piscataquis county specimen (*Norton s.n.* NY) however is *Arctoa blytii* (Schimp.) Loesk, while the Oxford county specimen (*Allen 22212* MO) is *Cynodontium strumiferum.*

Acknowledgments. I thank the curators of FH, MAINE, NEBC, and NY for the loan of specimens, and William R. Buck (NY) for nomenclatural help.

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## Additions to the Lichen of the Huron Mountain Club

**William R. Manierre**[1]

My recent article on the "Bryophytes and Lichens of the Huron Mountain Club" (1999) lists 280 lichen species as having been found within the boundaries of this protected holding in Marquette County of Michigan's western Upper Peninsula. The present note adds 35 taxa to this total. Seventeen of these represent my own findings as part of the original, ongoing project during the year subsequent to completion of the article.

Of the remaining 18 species, six were collected by Henry A. Imshaug [*] in 1949 and 12 by his student, James Malachowski [#] in 1976. These are deposited at MSC, with the exception of *Melanelia elegantula* (Zahlbr.) Essl. and *Phaeophyscia erythrocardia* (Tuck.) Essl., which are at MICH.

The original nomenclature remains here as it appears in Dr. Alan M. Fryday's forthcoming "Checklist of Lichens and Allied Fungi of Michigan," which is soon to appear in the *Contributions from the University of Michigan Herbarium*. It is through Dr. Fryday's manuscript that I first learned of the Imshaug and Malachowski collections at the Huron Mountain Club. Their contributions help to raise the total of lichens found there to 315.

*Acrocordia megalospora* (Fink) R.C. Harris
*Aspicilia cinerea* (L.) Korber
#*Baeomyces rufus* (Hudson) Repent.
*Biatora vernalis* (L.) Fr.
*Buellia arnoldii* Servit & Nadv.
*Cladonia sobolescens* Nyl. ex Vainio
#*Collema pulchellum* Ach.
*Cyphelium lucidum* (Th.Fr.) Th. Fr.
*Fuscopannaria leucophaea* (Vahl) P.M. Jorg.
#*Lecanora carpinea* (L.) Vainio
#L. *cateilea* (Ach.) A. Massal.
L. *strobilina* (Sprengel) Kieffer
L. *symmicta* (acxh.) Ach.
*Lepraria caesioalba* (de Lesd.) J.R. Laundon
#*Leptogium milligranum* Sierk
#*Loxospora elatina* (Ach.) A. Massal.
*Megaspora verrucosa* (Ach.) Hafellner & V. Wirth
**Melanelia elegantula* (Zahlbr.) Essl.

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#*M. fuliginosa* (Fr. ex Duby) Essl.
M. *subolivacea* (Nyl.) Essl.
# *Peltigera degenii* Gyelnik
**Pertusaria consocians* Dibben
**Phaeophyscia erythrocardia* (Tuck.) Essl.
#*Physcia subtilis* Degel.
**Polychidium muscicola* (Sw.) Gray
**Psora globifera* (Ach.) A. Massal.
#*Ramalina dilacerata* (Hoffm.) Hoffm.
#R. *obtusata* (Arnold) Bitter
**Rhizocarpon grande* (Flörke ex Flotow) Arnold
R. *obscuratum* (Ach.) A. Massal.
*Rinodina archaea* (Ach.) Arnold
R. *dakotensis* H. Magn.
*Staurothele fissa* (Taylor) Zwackh.
#*Stereocaulon subcoralloides* (Nyl.) Nyl.
*Tuckermannopsis sepincola* (Ehrh.) Hale
*Xanthoparmelia cumberlandia* (Gyelnik) Hale
    "narrow-leaved form" (Irwin M. Brodo)

Acknowledgements. My thanks to Irwin M. Brodo, John W. Thomson, Clifford M. Wetmore, Richard C. Harris, and Howard A. Crum for help in identifying species and for general support and encouragement.

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# Bryophytes of the Interior Highlands of North America: *Ephemerum serratum and Phaeoceros oreganus* New to Interior Highlands and Missouri, *Grimmia longirostris* New to Oklahoma, plus Other County Records

**Carl E. Darigo**[1]

This paper reports on bryophytes of the Interior Highlands of North America, including *Ephemerum serratum* (Hedw.) Hampe and *Phaeoceros oreganus* (Aust.) Hässel new to the Interior Highlands and Missouri, *Grimmia longirostris* Hook. new to Oklahoma, plus other county records.

The Interior Highlands of North America, divided into several topographic regions, includes the southern portion of Missouri, much of Arkansas, a small section of southern Illinois and extends along the eastern border of Oklahoma.

New moss county records distributed as follow:
MISSOURI--17
Border Counties (1): Montgomery-1
Mississippi Lowlands (1): Scott-1
St. Francois Mountains (6): Iron-3, Reynolds-3
Salem Plateau (9): Cape Girardeau-1, Franklin-1, Howell-1, Jefferson-1, Perry-1, Shannon-1, Taney-2, Washington-1
OKLAHOMA--2
Springfield Plateau (2): Delaware-2
ARKANSAS--1
Salem Plateau-1: Marion-1

New liverwort county records distributed as follow:
ARKANSAS--1
Mississippi Lowlands (1): Mississippi-1
MISSOURI--7
Border Counties (1): St. Charles-1

St. Francois Mountains (1): Iron-1
Salem Plateau (5): Jefferson-1, Ste. Genevieve-1, Stoddard-2, Wayne-1

New hornwort county record follows:
MISSOURI--1
Salem Plateau (1): Howell-1

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Most moss specimens (see Acknowledgments) were verified by Bruce Allen, hornwort by Alan Whittemore, and liverworts by Bruce Allen, Steve Timme and Alan Whittemore. Basis for existing Interior Highlands moss county record data is from Redfearn (2000), liverwort and hornwort data from Timme & Redfearn (1997) and Gier (1955), and Oklahoma moss county record data from Bowers (1991). All collections are at MO. Missouri county records are indicated by county name only, while Arkansas and Oklahoma records are identified by county and state abbreviation.

## MOSSES

### AMBLYSTEGIACEAE

*Hygroamblystegium fluviatile* (Hedw.) Loeske **Cape Girardeau**: Ranney Creek, Brant 4632A.

*Leptodictyum riparium* (Hedw.) Warnst.-*laxirete expression* **Reynolds**: Gunnis Creek/Ozark Trail crossing, Brant & O'Donnell 4604. Occurs in flowing water with leaves somewhat more erect than complanate, resembling *Fontinalis* Hedw.

### BRYACEAE

*Bryum capillare* Hedw. var. *capillare* **Taney**: Hercules Glades Wilderness, Darigo 3638.

### DITRICHACEAE

*Ceratodon purpureus* (Hedw.) Brid. var. *purpureus* **Montgomery**: Wellsville Lake Conservation Area, Darigo & Darigo 3608.

### EPHEMERACEAE

*Ephemerum serratum* (Hedw.) Hampe **Scott**: private property, county road 335, south of county road 332, Brant 4561. This specimen, which was collected on 14 September 2000 growing below other vegetation on sand of pond flats at 330 feet elevation, is a new record for the Interior Highlands and Missouri. Per Virginia Bryan (2001), the species has been found in Indiana, Kentucky, Mississippi and Tennessee, so occurrence in the Interior Highlands and Missouri is not unexpected.

### FISSIDENTACEAE

*Fissidens dubius* P. Beauv. **Marion-AR**: Hwy 125, north of Bull Shoals Lake ferry, Darigo 3640.

### FONTINALACEAE

*Fontinalis sphagnifolia* (C. Müll.) Wijk. & Marg. **Iron**: Bell Mountain Wilderness, Brant 4638. Has been reported in only two other Missouri counties and is listed as S1 (critically iimperiled) in the state "Species of Conservation Concern Checklist" (2000).

*F. welchiana* Allen **Howell**: White Ranch Conservation Area, Summers 9718.

FUNARIACEAE

*Physcomitrium pyriforme* (Hedw.) Hampe **Jefferson**: Pacific Palisades Conservation Area, Summers et al 9634

GRIMMIACEAE

*Grimmia laevigata* (Brid.) Brid. **Delaware-OK**: Dripping Springs, Ikenberry. Mixed with *G. longirostris* Hook. as discussed below.

*G. longirostris* Hook. **Delaware-OK**. Dripping Springs, Ikenberry. This specimen, mixed with *G. laevigata* (Brid.) Brid., was collected 19 July 1950 on rocky rim of a canyon. The original determination of *G. pilifera* P. Beauv. was annotated by J. Muñoz 1998. *Grimmia longirostris* is common in western North America, but had not been previously reported for Oklahoma; Interior Highlands has one other listing, as *G. affinis* Hoppe & Hornsch. *ex* Hornsch., in southern Illinois.

*Schistidium apocarpum* (Hedw.) Bruch & Schimp. *in* B.S.G. **Reynolds**: Johnsons Shut-Ins State Park, Darigo & Darigo 3658.

HELODIACEAE

*Helodium paludosum* (Sull.) Aust. **Shannon**: Angeline Conservation Area, Smith 3685. Reported in only four other Missouri counties and listed as S1 (2000).

POLYTRICHACEAE

*Atrichum altecristatum* (Ren. & Card.) Smyth & Smyth **Franklin**: Robertsville State Park, Darigo & Darigo 3612. **Washington**: Pea Ridge Conservation Area, Darigo 3615. These collections, both with sporophytes, were originally determined as *A. undulatum* (Hedw.) P. Beauv., but using characteristics defined in Ireland (1969) fit *A. altecristatum* very well. Only three other listings have been reported for *A. altecristatum* in Missouri and the Interior Highlands; per Robert Ireland (2001), the possibility exists that many previous collections have been mis-identified as *A. undulatum.*

POTTIACEAE

*Gymnostomum aeruginosum* Sm. **Reynolds**: Gunnis Creek/Ozark Trail crossing, Brant & O'Donnell 4603.

*Hymenostylium recurvirostre* (Hedw.) Dix. **Iron**: fen/seep, Oates Quadrangle, Brant 3675.

*Weissia controversa* Hedw. **Iron**: Bell Mountain Wilderness, Darigo 3647.

*W. sharpii* Anderson & Lemmon **Taney**: Hercules Glades Wilderness, Darigo 3641.

THUIDIACEAE

*Cyrto-hypnum pygmaeum* (Schimp. in B.S.G.) Buck & Crum **Perry**: Ball Mill Resurgence Natural Area, Smith & Jacobs 3963.

## LIVERWORTS

ADELANTHACEAE

*Odontoschisma prostratum* (Sw.) Trev. **Stoddard**: Holly Ridge Conservation Area, Summers & Galvin 9550B.

JUBULACEAE

*Frullania eboracensis* Gott. **Mississippi-AR**: Big Lake National Wildlife Refuge, Darigo 3209. **St. Charles**: Busch Conservation Area, Darigo & Darigo 3273.

*F. ericoides* (Nees) Nees **Wayne**: Lake Wappapello State Park, Darigo 3267.

MARCHANTIACEAE

***Marchantia polymorpha*** L. **Ste. Genevieve**: Lost Corners Farm, Lawrenceton, Holmberg 15.

PALLAVICINIACEAE

***Pallavicinia lyelii*** (Hook.) Carruth. **Stoddard**: Holly Ridge Conservation Area, Summers & Galvin 9550A.

PORELLACEAE

*Porella pinnata* L. **Iron**: Bell Mountain Wilderness Area, Brant 4679.

RICCIACEAE

*Ricciocarpos natans* (L.) Corda **Jefferson**: Pacific Palisades Conservation Area, Summers et al 9632.

## HORNWORT

ANTHOCEROTACEAE

*Phaeoceros oreganus* (Aust.) Hässel **Howell**: White Ranch Conservation Area, Allen 22363. This specimen, collected 10 June 2000 on bare soil along a trail, represents a new record for the Interior Highlands and state of Missouri. According to Hässel (1989), the species has been reported for North America in Oregon and Louisiana.

Acknowledgments: the author wishes to thank Bruce Allen, Alan Brant, Nels Holmberg, Tim Smith and Bill Summers for permission to publish their collections, Frank Bowers for use of his Oklahoma moss checklist (1991), Robert Ireland for information and determining *Atrichium* specimens, Virginia Bryan for information and determining the *Ephemerum* specimen, Bob Magill for determining *Weissia sharpii*, Jesús Muñoz for annotating the *Grimmia* specimen, Ron Pursell for determining the *Fissidens* specimen, Bruce Allen, Steve Timme and Alan Whittemore for sharing their time and expertise, and Dolly Darigo for her collecting help.

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# A second locality for *Xanthoparmelia idahoensis* Hale, an endangered vagrant lichen, new to Canada

**Bernard Goffinet[1], Roger Rosentreter[2] and Emmanuël Sérusiaux[3]**

In North America, the genus *Xanthoparmelia* (Vainio) Hale comprises 55 species (Thomson 1993). Of these, several species can be characterized as vagrant, and in the western part of the continent, at least 8 such species have been recognized (Rosentreter 1993). Although chemical differentiation has been emphasized (Hale 1990), most of the species can easily be distinguished by morphological features (Rosentreter 1993).

In 1994, the senior author received a specimen of a seemingly vagrant lichen from southern Saskatchewan for identification. This specimen was identical in its chemistry to *X. idahoensis*, as it produced usnic, salazinic and consalazinic acids. It should be noted that protocetraric acid, which is reported as occurring in trace amounts in *X. idahoensis* (Hale 1990) has not been detected in either the Canadian material nor the isotype deposited in the herbarium of R. Rosentreter. Instead, both samples shared another compound reacting yellow after heat and acid treatment, which appeared, based on comparison with a chemical profile of *Menegazzia terebrata* (Hoffm.) A. Massal., similar to the unidentified Mtr-1 reported by Culberson et al. (1981).

*Xanthoparmelia idahoensis* was previously known only from two sites near Salmon, Lehmi County in Idaho, where it grew on calcareous lacustrine ash soil. This species appears to prefer frigid arid regions with very sparse vascular plant cover. Generally sites where this species occurs are considered relatively barren " badlands ". The Idaho and Canada sites are similar climaticly and vegetatively. Detailed ecological informations for the Saskatchewan site are lacking. *Xanthoparmelia idahoensis* should be searched for in frigid arid steppes and badland sites within the arid intermountain region.

**Specimen examined**: CANADA, Saskatchewan, N. of Val Marie (E border of Cypress Hills), NW corner of grassland Park (W portion of park), W of Ecotour road (major road through park). T3 R12 S16, Bob Ellis, summer 1994 (ALTA, herbarium Goffinet, herbarium Rosentreter).

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# *Bryum alpinum* and *Grimmia donniana*, New to Michigan

**William R. Manierre**[1]

In a recent *Evansia* article Howard Crum (1997) remarks that "the moss flora of Michigan has been so well attended that one scarcely expects to find anything new." Given this limited expectation it is evident that additions to this flora deserve mention in the literature.

On May 15, 1999, two mosses not previously reported from Michigan were collected less than an eighth of a mile apart at about 1000 ft. elevation on the south slope of Huron Mountain in Marquette County of Michigan's western Upper Peninsula (T52N R28W SW1/4 of NW1/4 of section 30). They are *Grimmia donniana* Sm and *Bryum alpinum* Huds. ex With. and are reported here for the first time in the state.

Howard Crum determined the Bryum and William Buck the *Grimmia*. Specimens of both are in my personal herbarium and specimens of the *Grimmia* are in NY. All are in sterile condition.

Crum and Anderson (1981) name several eastern states from which *Grimmia donniana* has been reported but add categorically that it is "Rare in the East" (p. 427). *Bryum alpinum* is even rarer in that part of the country for which only a single citation is given: "presumably [in] the White Mountains of New Hampshire" (p. 564). More frequently reported from the West, these species share a similar range "from British Columbia to California and inland to Montana and Colorado." I find no reference to the appearance of either in more central parts of the country. It seems probable that both Michigan finds increase range significantly and are, quite possibly, not merely firsts for Michigan but for the Middle West as well.

The shiny, beautiful red and golden tufts of *Bryum alpinum* grew on wet duff and colluvium on and within a small perennial seep following a series of cracks and fissures in the granitoid gneiss of the bedrock. These plants were few in number.

The dark green tufts of *Grimmia donniana* grew more abundantly on the bedrock as well as on a neighboring intrusion of quartz. The overall location has been described as "rugged exposed crystalline bedrock terrain where the mantle of glacial sediment has been removed by erosion" (Simpson, 1990).

It is best to get them in the record while they are still there.

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# A *Brachythecium* of Michigan Worthy of Note

**Howard Crum**

On describing *Brachythecium oxycladon* fo. *falcatum*, Grout said it was "a very interesting form unlike anything I have seen before." And indeed it is interesting. It is quite unlike *B. oxycladon* or any other member of that troublesome genus. The shiny, green or yellow plants are attractive. They are small and freely branched. The leaves are strongly plicate, with several folds rather than the two normal to the genus. The leaf margins are recurved on one side, and the alar cells are short-oblong in small triangular groups that are not at all obscure and not merely an extension of short cells across the insertion. The plants are autoicous in sexuality and quite easy to recognize, by aspect as well as structure, and worthy of notice at a specific rank. Insofar as now known, the species is limited to northern Michigan, where it grows on light soils in exposed places, such as lake shores. It was first collected at the University of Michigan Biological Station, where it has no doubt escaped notice because one tends to assume that a small pleurocarp — and especially a *Brachythecium* — in marginal habitats would, of course, lack interest.

***Brachythecium falcatum*** (Grout) n. stat. (*B. oxycladon* fo. *falcatum* Grout, Moss Flora No. Amer. 3: 36. 1928). — Plants small, closely and freely branched, in flat, shiny yellow or bright green mats. Stem and branch leaves similar. Branches horizxontal, short, densely foliate. Branch leaves falcate-secund, distinctly plicate in addition to being biplicate, 1.4 mm long, lance-acuminate, revolute on 1 side nearly throughout, serrulate toward the apex; costa ending about 2/3-3/4 up the leaf; upper cells linear, shorter and broader in 4-6 rows along the margin, in small, triangular alar groups, not at all obscure, the cells at the insertion also short and broad. Autoicous. Setae ca. 0.8 cm long, smooth; capsules 2 mm long, horizontal, brown; peristome perect, hypnoid, red-brown, the cilia well developed, apparently single.

Cheboygan Co. Dry banks bordering Douglas Lake, *G. E. Nichols 141*, June - August 1920 (isotype, MICH); on sandy soil, Biological Station, *M. L. Ehrmann*, June 27, 1948 (MICH). — Chippewa Co. Hardwoods, MI 123, T49N, R7W, sect. 24, *A. Olivero*, August 6, 1984 (MICH). — Crawford Co. Sandy soil, Hartwick Pines, *H. A. Gleason 2355*, August 11, 1939 (MICH). — Emmet Co. Waugoshance Point, *D. Dunlap & D. Hibbett 397*, August 3, 1984 (MICH).

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# Bryophyte Records for Arkansas II

**Piers Majestyk**[1]

Examination of the approximately 1000 specimens of bryophytes collected from Arkansas and housed in the herbarium at NY has revealed 123 county records. Two of these, *Philonotis uncinata* (Schwaegr.) Brid. and *Solenostoma gracillimum* (Sm.) Schust., are reported for the first time in the state. *Plagiomnium rostratum* (Schrad.) T. Kop., reported for Arkansas by Crum & Anderson (1981), is confirmed for the state. Collections are listed alphabetically by family. County names are in bold face. Collector names and collection numbers are italicized and follow the county name. New state records are proceeded by an asterisk. Nomenclature for the mosses follows Anderson (1990) and Anderson et al. (1990). Liverwort and hornwort nomenclature for the most part follows Stotler & Crandall-Stotler (1977).

## Mosses

### AMBLYSTEGIACEAE

*Amblystegium serpens* (Hedw.) Schimp. - **Faulkner**: *Welch 2958.*

*Campylium chrysophyllum* (Brid.) J. Lange - **St. Francis**: *McDaniel 5500.*

*Hygroamblystegium tenax* (Hedw.) C. Jens. - **Madison**: *Buck: 37362*; **Washington**: *Anderson 12296.*

*Leptodictyum riparium* (Hedw.) Warnst. - **Benton**: *Hermann 27690*; **Lincoln**: *Bush 91*; **Marion**: *Anderson 12316*; **Newton**: *Magill et al. 7503.*

### ANOMODONTACEAE

*Anomodon rostratus* (Hedw.) Schimp. - **Garland**: *Voth V525*; **Logan**: *Welch 2959.*

### AULACOMNIACEAE

*Aulacomnium heterostichum* (Hedw.) Schimp. - **Lee**: *McDaniel 5510.*

*A. palustre* Sw. - **Pulaski**: *Russell 2.*

### BARTRAMIACEAE

*Philonotis longiseta* (Rich.) E. G. Britt. - **Polk**: *Whitehouse s.n.*; **Scott**: *Whitehouse 23357*; **Stone**: *Anderson 11673.*

**P. uncinata* (Schwägr.) Brid. - **Garland**: *Gier 238.*

### BRACHYTHECIACEAE

*Brachythecium salebrosum* (Web. & Mohr) Schimp. - **Stone**: *Buck 15877.*

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BRUCHIACEAE
*Bruchia flexuosa* (Schwägr.) Müll. Hal. - **Lincoln**: *Bush 195.*

BRYACEAE
*Pohlia nutans* (Hedw.) Lindb. - **Crawford**: *Anderson 12387.*
*Rhodobryum ontariense* (Kindb.) Par. - **Randolph**: *Johnson 1320.*

BRYOXIPHIACEAE
*Bryoxiphium norvegicum* (Brid.) Mitt. - **Madison**: *Buck 37343*; **Stone**: *Hatcher 86.*

CLIMACIACEAE
*Climacium kindbergii* (Ren. & Card.) Grout - **Franklin**: *Buck 37297*; **Hempstead**: *Gier 229.*

CRYPHAEACEAE
*Cryphaea glomerata* Bruch & Schimp. *ex* Sull. - **Carroll**: *Buck 38727.*

DITRICHACEAE
*Ceratodon purpureus* (Hedw.) Brid. - **Franklin**: *Buck 37213.*
*Pleuridium subulatum* (Hedw.) Rabenh. - **St. Francis**: *McDaniel 5960.*

ENTODONTACEAE
*Entodon macropodus* (Hedw.) Müll. Hal. - **Cleburne**: *Johnson 1327*; **White**: *Johnson 1312.*
*E. seductrix* (Hedw.) Müll. Hal. - **St. Francis**: *McDaniel 5493.*

FISSIDENTACEAE
*Fissidens adianthoides* Hedw. - **Newton**: *Johnson 1315.*
*F. elegans* Brid. - **Franklin**: *Buck 15792.*
*F. fontanus* (Bach. Pyl.) Steud. - **Benton**: *Hermann 27689*; **Washington**: *Gier s.n.*
*F. obtusifolius* Wilson - **Benton**: *Hermann 27692.*
*F. subbasilaris* Hedw. - **Marion**: *Buck 15821.*

FONTINALACEAE
*Brachelyma subulatum* (P. Beauv.) Schimp. *ex* Card. - **Cleburne**: *Johnson 1326.*
*Fontinalis flaccida* Ren. & Card. - **Drew**: *Demaree 22722*; **Stone**: *Buck 15881.*
*F. sullivantii* Lindb. - **Craighead**: *Demaree 26541*; **Lincoln**: *Cardot 92.*
*F. welchiana* Allen - **Conway**: *Anderson 11916*; **Saline**: *Demaree 46397.*

FUNARIACEAE
*Funaria hygrometrica* (L.) Hedw. - **Logan**: *Welch 2910.*

*F. serrata* Brid. - **Hempstead**: *Bush s.n.*

GRIMMIACEAE

*Schistidium apocarpum* (Hedw.) Bruch & Schimp. - **Logan**: *Welch 2907.*
*S. rivulare* (Brid.) Podp. - **Baxter**: *Bowers 22210A*; **Benton**: *Hermann 27688*; **Searcy**: *Buck 15860.*

HYPNACEAE

*Isopterygium tenerum* (Sw.) Mitt. - **Hempstead**: *Bush s.n.*
*Pylaisiella selwynii* (Kindb.) Crum, Steere & Anderson - **Searcy**: *Buck 15856.*

LESKEACEAE

*Haplocladium virginianum* (Brid.) Broth. - **Van Buren**: *Ireland 16357.*
*Leskea australis* Sharp - **Lee**: *McDaniel 5528.*
*L. polycarpa* Hedw. - **Marion**: *Buck 15816.*

MNIACEAE

*Plagiomnium cuspidatum* (Hedw.) T. Kop. - **St. Francis**: *McDaniel 7267.*
*Plagiomnium rostratum* (Schrad.) T. Kop. - **Madison**: *Buck 37372.*

ORTHOTRICHACEAE

*Orthotrichum pusillum* Mitt. - **Franklin**: *Buck 15794.*
*O. strangulatum* P. Beauv. - **Benton**: *Hermann 27736.*

PLAGIOTHECIACEAE

*Plagiothecium cavifolium* (Brid.) Iwats. - **Searcy**: *Buck 15860C.*

POLYTRICHACEAE

*Polytrichum commune* Hedw. - **Scott**: *Churchill 7455-c.*
*P. juniperinum* Hedw. - **Hot Spring**: *Magill 13307.*

POTTIACEAE

*Oxystegus tenuirostris* (Hook. & Tayl.) A. J. E. Sm. - **Searcy**: *Redfearn 14298.*
*Pleurochaete squarrosa* (Brid.) Lindb. - **Newton**: *Buck 37487.*
*Syntrichia pagorum* (Milde) Amann - **Benton**: *Hermann 27693a.*
*Weissia controversa* Hedw. - **Lee**: *McDaniel 5506*; **Van Buren**: *Ireland 16340.*

PTYCHOMITRIACEAE

*Ptychomitrium drummondii* (Wilson) Sull. - **Howard**: *Gier 210*; **Lee**: *McDaniel 5529.*

SPHAGNACEAE

*Sphagnum affine* Ren. & Card. - **Jefferson**: *Lock 4078.*

*S. compactum* DC. *in* Lam. & DC. - **Polk**: *Anderson 11425.*
*S. lescurii* Sull. - **Cleburne**: *Johnson 1332*; **Scott**: *Churchill 7459.*
*S. palustre* L. - **Greene**: *Demaree 26682.*
*S. recurvum* P. Beauv. - **Dallas**: *Demaree 48023.*

THUIDIACEAE
*Thuidium delicatulum* (Hedw.) Schimp. - **Baxter**: *Bowers 22213-A.*

## Liverworts and Hornworts

ANEURACEAE
*Aneura pinguis* (L.) Dum. - **Stone**: *McGregor 5398.*
*Riccardia palmata* (Hedw.) Carruth. - **Marion**: *McGregor 5424.*

ANTHOCEROTACEAE
*Aspiromitus punctatus* (L.) Schljakov subsp. *agrestis* (Paton) Schust. var. *agrestis* - **Franklin**: *McGregor 3698.*

AYTONIACEAE
*Asterella tenella* (L.) P. Beauv. - **Marion**: *McGregor 5420.*
*Reboulia hemisphaerica* (L.) Raddi - **Independence**: *Coville 16*; **Izard**: *McGregor 5365.*

CALYPOGEIACEAE
*Calypogeia fissa* (L.) Raddi subsp. *neogaea* Schust. - **Faulkner**: *Welch 2983*; **Logan**: *Welch 2985*; **Marion**: *McGregor 5427.*
*C. muelleriana* (Schiffn.) K. Müll. subsp. *muelleriana* - **Greene**: *Demaree 26707.*

CEPHALOZIACEAE
*Odontoschisma prostratum* (Sw.) Trev. - **Izard**: *McGregor 5367*; **Marion**: *McGregor 5426.*

CONOCEPHALACEAE
*Conocephalum conicum* (L.) Dum. - **Randolph**: *Demaree 26809.*

GEOCALYCACEAE
*Geocalyx graveolens* (Schrad.) Nees - **Stone**: *McGregor 5394.*

JUBULACEAE
*F. brittoniae* Evans - **Izard**: *McGregor 5372*; **Van Buren**: *Ireland 16364.*
*F. eboracensis* Gottsche - **Logan**: *Mcgregor 4770*; **Pulaski**: *Coville 3.*
*F. ericoides* (Nees ex Mart.) Mont. - **Logan**: *McGregor 4769*; **Pulaski**: *Coville 5*; **St. Francis**: *McDaniel 5496.*

*F. inflata* Gottsche - **Marion**: *McGregor 5357*; **Stone**: *McGregor* 5403.
*F. kunzei* Lehm. & Lindenb. - **Pulaski**: *Coville 4*.
*Jubula pennsylvanica* (Steph.) Evans - **Logan**: *McGregor 4768*.

JUNGERMANNIACEAE
*Jamesoniella autumnalis* (Decand.) Steph. - **Marion**: *McGregor 5425*.
**Solenostoma gracillimum* (Sm.) Schust. - **Drew**: *Demaree 22820*.

LOPHOCOLEACEAE
*Chiloscyphus pallescens* (Ehrh.) Dum. - **Garland**: *Demaree 22741*; **Stone**: *McGregor 5400*.
*C. profundus* (Nees) Engel & Schust. - **Boone**: *Redfearn 11769*; **Marion**: *McGregor 5428*.

METZGERIACEAE
*Metzgeria conjugata* Lindb. - **Montgomery**: *Demaree 47054*.

PALLAVICINIACEAE
*Pallavicinia lyellii* (Hook.) Carruth. - **Izard**: *McGregor 5366*.

PLAGIOCHILACEAE
*Plagiochila ludoviciana* Sull. - **Montgomery**: *Redfearn 21214*.
*P. undata* Sull. - **Logan**: *Redfearn 21581*.

PORELLACEAE
*Porella pinnata* L. - **Lee**: *McDaniel 5504*.
*P. platyphylla* (L.) Pfeiff. - **Clark**: *Underwood s.n.*; **Independence**: *Coville 1*; **Lee**: *McDaniel 5509*; **Logan**: *Welch 2998*; **Marion**: *McGregor 5355*; **St. Francis**: *McDaniel 5525*.

RADULACEAE
*Radula complanata* (L.) Dum. - **Izard**: *McGregor 5378*; **Marion**: *McGregor 5423*.

RICCIACEAE
*Riccia frostii* Aust. - **Pulaski**: *Coville 11*.

SCAPANIACEAE
*Scapania nemorosa* (L.) Dum. - **Drew:** *Demaree 22821.*
*S. undulata* (L.) Dum. - **Faulkner**: *Welch 2981.*

SPHAEROCARPACEAE
*Sphaerocarpos texanus* Aust. - **St. Francis**: *McDaniel 5523.*

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# EVANSIA

Volume 18 Number 3

*Weissia brachycarpa* (Nees & Hornsch.) Jur. new to the State of Maine
Bruce Allen 69

Pacific Northwest Sea Stack Cryptogams:
I. *Scapania scandica* in Oregon
Steven L. Jessup 73

*Leucocarpia biatorella* (Verrucariaceae), new to North America
William R. Buck and Richard C. Harris 82

Bryophytes of the Interior Highlands of North America:
Arkansas and Missouri New County Records plus Corrections
Carl E. Darigo 84

Additions to the lichen flora of North America ??.
*Agonimia allobata* and *Aspicilia grisea*
Alan M. Fryday 87

*Calicium corynellum* (Ach.) Ach. in the United States,
and *Calicium montanum* Tibell new for North America
Annette Kolb and Toby Spribille 90

An improved miniprep method of DNA extraction for bryophytes.
James Bray Jr. & Kelsi Scott 93

Mosses of Simcoe County, Ontario
Frank S. Cook 97

Mosses from Cameron County, Pennsylvania
Bruce Allen & Ronald A. Pursell 104

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# *Weissia brachycarpa* (Nees & Hornsch.) Jur. new to the State of Maine

**Bruce Allen**

While searching for spring ephemerals recently I encountered an odd *Weissia* that on closer examination was found to be *Weissia brachycarpa* (Nees & Hornsch.) Jur. This species has not previously been reported from Maine. Crum and Anderson (1981) considered it, as *W. hedwigii* Crum, to be rare but widely distributed in eastern North America. They included nearby Massachusetts in its range. *Weissia brachycarpa* has since been reported from Nova Scotia (Ireland 1982, Allen 1984), Ontario (Eckel 1997, 1999), and New York (Eckel 1987, Eckel & Eckel 1988).

The best features separating *Weissia brachycarpa* from *W. controversa* Hedw. are found in its sporophytes. *Weissia brachycarpa* has obliquely mouthed capsules and no peristome. Furthermore, the capsule mouth is nearly closed by a horizontal membrane attached just below the capsule rim. The presence of this type of capsule membrane is the basis for the segregate genus *Hymenostomum*. The membrane is usually termed an "imperfect membrane" since it does not completely close the capsule mouth (see Fig. 1 A). Nevertheless, when a mature capsule, after the operculum is removed, is squeezed with a needle or forceps the spores remain in capsule. This seems to be due an especially resistant spore sac that plugs the gap in the imperfect membrane.

The gametophytes of *W. brachycarpa* and *W. controversa* are also distinct. *Weissia brachycarpa* has remarkably variable leaf margins. In single collections leaves can be found with margins plane, weakly incurved, or involute. A quick or superficial examination of the species could in fact confuse it with *Trichostomum*. In *W. controversa*, on the other hand, the leaves are consistently involute. The leaves of *W. brachycarpa* also have stoutly excurrent costae (in a manner similar to those of *Barbula unguicula* Hedw.) with smooth, elongate superfical cells on the upper, ventral surfaces. In contrast the costae in *W. controversa* are percurrent to shortly excurrent with papillose, quadrate superfical cells on the upper, ventral surfaces. The differences in their superficial costal cells is evident in costal cross-sections as well as surface views. Although *W. brachycarpa* has been reported as "apparently dioicous" (Crum & Anderson 1981), the Maine collections of this species are autoicous.

In Maine *W. brachycarpa* was collected in weedy, disturbed places indicating it may be a common but infrequently collected moss rather than a rare species. As

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species can with most ephemerals there may be only a short time period within which the be be collected. Interestingly, Eckel (1997) in reporting *W. brachycarpa* from an Ontario site noted she was unable to recollect it there despite several attempts.

Key to the species of *Weissia* in Maine

1. Leaves apiculate to cuspidate; costae stoutly excurrent, upper ventral surface cells elongate and smooth; margins varing from plane to weakly incurved to involute; capsules oblique at mouth; peristome lacking, capsule mouth closed by an imperfect membrane ....................................... *W. brachycarpa*
1. Leaves acute to gradually apiculate; costae percurrent to shortly excurrent, upper ventral surface cells quadrate and papillose; margins consistently involute; capsules horizontal at mouth; peristome present ..... *W. controversa*

*Weissia brachycarpa* (Nees & Hornsch.) Jur., Laubm.-Fl. Oesterr.-Ung. 9. 1882.

*Hymenostomum brachycarpa* Nees & Hornsch., Bryol. Germ. 1: 196. 1823. *Hymenostomum microstomum* var. *brachycarpa* (Nees & Hornsch.) Hüb., Muscol. Germ. 67. 1833.

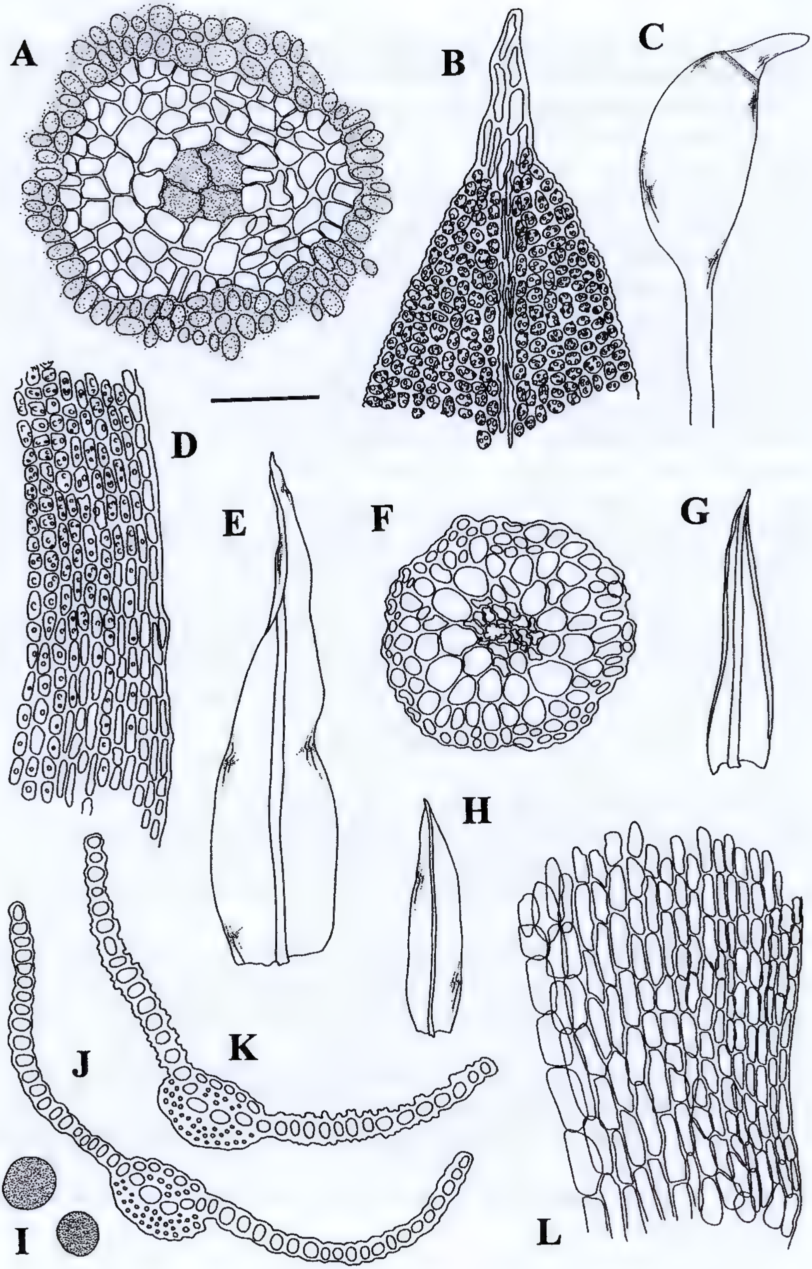
*Gymnostomum microstoma* Hedw., Sp. Musc. Frond. 33. 1801. *Hymenostomum microstomum* (Hedw.) R. Brown *in* Nees & Hornsch., Bryol. Germ. 1: 196. 1823. *Weissia microstoma* (Hedw.) C. Müll., Syn. Musc. Frond. 1: 660. 1849, a later homonym of *W. microstoma* Hornsch. *ex* Nees, Hornsch. & Sturm, 1831.

*Weissia hedwigii* Crum, Bryologist 74: 169. 1971, a new name for *Weissia microstoma* (Hedw.) C. Müll. 1849.

Plants small, green to yellow-green above, brown below, in tufts, 1–3 mm high. Stems red, erect, hyalodermis not developed, central strand well-developed, sparsely and irregularly branched; rhizoids sparse, red, smooth.

---

Figure 1. *Weissia brachycarpa.* A. Capsule mouth, top view showing imperfect membrane nearly covering mouth. B. Leaf apex. C. Capsule and operculum. D. Leaf cells and margin at top of leaf sheath. E. Perichaetial leaf. F. Stem in cross-section. G. & H. Vegetative leaves. I. Spores. J. Leaf cross-section at base. K. Leaf cross-section above midleaf. L. Basal leaf cells and margin. Scale bar in mm: bar = 0.05 (B, J, K,I); bar = 0.06 (A,D,F,L); bar = 0.5 (E,H,G); bar = 0.6 (C). Figures A,C,D,E,G–I, L from *Allen 23053* (MO), figures B,F,J,K from *Allen 23059* (MO).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Leaves 1.5–2.0 mm long, linear-lanceolate to lanceolate, weakly clasping at base, erect at base, crisped to spirally contorted, and tubulose above when dry, erect-flexuose to erect-spreading when wet, apiculate to cuspidate; lamina unistratose, firm not fragile; margins entire, varing from plane to weakly incurved to involute; costa stoutly excurrent, broad at base (50–60 µm), cells on ventral surface elongate, smooth, guide cells and two stereid bands well-developed, ventral surface somewhat enlarged; upper cells rounded to quadrate, 6–12 µm long, thick-walled, bulging at the surface, with 2–4 papillae, basal cells rectangular, firm-walled, yellow or hyaline, smooth, 14–50 µm x 6–18 µm, outer basal cells hyaline, at times weakly running up the margins in a v-shaped pattern. Autoicous; perigonia terminal on short branches; perichaetia terminal, perichaetial leaves larger and longer than vegetative leaves. Setae smooth, 2–4 mm long, yellow; capsules ellipsoid, oblique at mouth, erect, 1–1.2 mm long, smooth or lightly furrowed when dry; stomata present in neck; opercula obliquely rostrate, 0.5 mm long; annuli with several rows of persistent cells; peristome absent, capsule mouth nearly closed by imperfect membrane. Spores 20–23 µm, papillose. Calyptrae yellow, cucullate, smooth, to 2 mm long. n = 13 or 26 (Fritsch 1991).

On soil, amongst grasses in fields and lawns. In Maine known from Cumberland (*Allen 23053* DUKE, MAINE, MO, NY, US) and York (*Allen 23059* MO) Counties.

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# Pacific Northwest Sea Stack Cryptogams: I. *Scapania scandica* in Oregon

**Steven L. Jessup**[1]

**Abstract.** A population of *Scapania scandica* (Arn. & Buch) Macvicar discovered in Curry County, Oregon on a near-shore sea stack is discussed and illustrated with photographs via the internet. The constellation of diagnostic characters closely matches published descriptions of *Scapania scandica.* Other possible diagnoses can be eliminated by the condition of one or more critical characters. *S. scandica* has not been previously found in the Pacific Northwest south of latitude 48°N, but its occurrence on the Oregon coast near latitude 42°N is consistent with the biogeographic distributions of other rare bryophytes and lichens. The biogeographic significance of sea stack and rocky headland mesohabitats is briefly reviewed.

**Introduction.** *Scapania* is a notoriously difficult taxonomic knot (Schuster, 1974, pp. 232-245). Diagnostic character suites lack coherence in many of the genotypically variable lineages and species limits are further confounded by copious phenotypic plasticity. The taxonomic result is such breadth in species descriptions for some taxa that phenotypic gaps are frequently obscure, and in some cases apparently nonexistent. The problem is further complicated by the fact that key diagnostic features associated with sexual reproduction (e.g. perianth morphology) are often unavailable in populations occupying extremes of environmental tolerances for a lineage, where sexuality is not expressed. Populations near the periphery of geographic distribution that are both sterile and express extreme phenotypes can be almost indeterminable. Keys, which by their very nature assert discrete phenotypic gaps, simply do not work for specimens outside the narrowly defined norms used for taxa included in the key.

Descriptions of known geographic distribution can serve as a guide, but in areas where range extensions are plausible or expected, known range is not much help, and may in fact bias determinations in favor of taxa known to occur regionally. Reliance on range descriptions to sway identifications could actually hinder close examination of critical plants. In any case, the tangled morass of morphological descriptions that must be comprehended for a clear determination is daunting for any but the most distinctive taxa in *Scapania* may have discouraged progress in documenting the distributions of some lineages.

---

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*Scapania scandica* (Arn. & Buch) Macvicar is one such diffusely bounded taxon that is relatively little known. The overlap of phenotypic expression between *S. scandica, S. mucronata, S. undulata* var. *oakesii*, and dwarfed *S. americana* presents a predicament requiring careful consideration of the distinguishing constellations of character expression found in each for a reasonably certain diagnosis of any in this group. Of course, the full characteristic expression of any one of these taxa, all of which occur in the Pacific Northwest, is not problematic, but, as is often the case in *Scapania*, populations of these taxa with individuals on the phenotypic fringe are frequently encountered[2]. The purpose of this report is to document a range extension for *S. scandica*, and to elucidate both the diagnostic characters of the species and those character states that eliminate other possible diagnoses.

Sea stacks on the Pacific Northwest coast have never been thoroughly surveyed for rare cryptogams. Oregon coast sea stacks combine critical mesohabitat features and geographic position in ways that predict a high incidence of rare cryptogams. The discovery of *S. scandica* on a relatively small near-shore sea stack hints that larger and more completely insular sea stacks may harbor a high incidence of disjunct populations. This report initiates a series dedicated to documenting the terrestrial cryptogamic flora of Pacific Northwest sea stacks and peninsular rocky headlands.

**Specimen Collection and Description.** The specimen (Jessup 17-89, deposited in SOC) was collected on a near-shore sea stack at 42°3'56"N, 124°18'47"W (NAD-1983) on vertical NNE-facing metabasalt above a narrow ledge at an elevation of approximately 30 m directly above sheltered intertidal rocks. The foot of the sea stack was approached on foot through the intertidal zone at low tide, and the site was accessed by free climbing the seaward face then crossing the ridge to the sheer north face and traversing along a narrow ledge. The climb was generally a class-3 route but involved class-4 maneuvers in a few places to reach the ledge. The most serious exposure occurred during class-4 moves near the ridgeline where wind, focused by the seaward bluff, was a gusty 40 knots. The collection site is shaded from direct sun but receives strong indirect light. Although the collection site is somewhat sheltered from exposure to direct wind, the entire sea stack mesohabitat is subject to a strong diurnal sea breeze and frequent summer morning fog and drizzle. The site is well above the intertidal spray zone, though blown spray likely wets the entire sea stack during winter storms.

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[2] According to Schuster, referring to the overlap of character configurations (1974, p. 435), "Occasional populations are impossible to place . . ." and (ibid. p. 451), ". . . *S. scandica* is variable to the point where its perimeters are almost undefinable, particularly at the northern periphery."

The dominant associated hepatic species at the site are *Marsupella emarginata, Porella navicularis*, *Cephaloziella byssacea,* and *Frullania franciscana,* all of which combine to form a nearly continuous cover on vertical rock faces at the collection site. Species found in small amounts in crevices on the same rock face include *Lophocolea cuspidata* and *Radula bolanderi.* The *Scapania* in question was found initially as scattered isolated shoots in pure patches of *Marsupella emarginata* and, on closer inspection, as small (1-2 cm$^2$) colonies of loosely aggregated plants growing within and on the margins of otherwise pure patches of *Cephaloziella byssacea.* The *Scapania* was not found outside of intimate association with other hepatics -- all were growing within dense hepatic associules over fine textured metabasalt.

**Specimen description** The following morphological description is illustrated with a series of photomicrographs available at:

www.sou.edu/biology/faculty/jessup/scapania/sscand.htm

**Plants** uniformly small with shoots (0.3)0.5-1.0(1.2)mm wide, by (5)6-10(15)mm long. **Stems** on the largest plants 170--180$\mu$ in diameter, the cortex uniformly of 1--2 differentiated cell layers, not at all flattened, with open lumens, the walls deep reddish brown, branches infrequent, laterally or ventrally intercalary. **Rhizoids** few, short, sparsely distributed along stem but absent near the apex. **Leaves** distally greenish to golden yellow-brown, adaxially red-brown to occasionally, under higher magnification, with a clear blush of red, and adaxially deeply vinaceous near the bases. **Leaf margins** evenly spinose denticulate in the distal ½--¾ on both dorsal and ventral lobes of all upper leaves, the teeth 1-2(3) cells high and typically 1-2 cells broad at base, the apical tooth sometimes somewhat larger, forming a slight mucro. Lower leaves occasionally edentate or with just a few scattered teeth. **Keel** .45--.55 the length of the ventral lobe, slightly arched to nearly straight, not at all winged or toothed, 1-2 stratose throughout. **Ventral lobes** subtransversely inserted, the line of insertion forming a slight to distinct arch, the postical margin not at all decurrent to slightly decurrent to level of keel insertion or just below keel insertion. Lobes ovate to obovate, the width approximately .7x the length, broadly rounded apically, not at all accuminate, though occasionally with a prominent apical tooth. **Dorsal lobes** transversely inserted, not at all decurrent. Lobes ovate, the width .7--.9x the length, the upper leaves broadly rounded apically to somewhat obtuse or occasionally acute on the lower leaves, frequently with a prominent apical tooth. Both dorsal and ventral lobes erect spreading to nearly squarrose at the apex, abaxially slightly concave, somewhat reflexed in the distal ¼, with a narrow zone of slight recurvature along the margin on dried plants. **Leaf cells** not discernably differentiated along the laminal margin, the walls uniformly thickened throughout, cell diameter averaging 15µ at the margins to 25µ near the lobe bases. **Cuticle** distinctly fine to roughly verrucose throughout, the laminal cells with obvious large papillae in surface view when imaged with phase interference microscopy. **Trigones** weakly convex to more often flat or somewhat concave, not at all bulging. **Oil bodies** 2-4(5) per cell, round to ovate, 2.5--5.0µ wide by 2.5--6.0(7.0) µ long, clear and finely granular. **Gemmae** abundantly produced on almost all plants observed, uniformly 2-celled, elliptic to oval or ovate, almost entirely deep pink-red to vineaceous, tending to colorless in a few plants, 12--15µ wide x 20--23µ long, the upper leaves occasionally eroded through gemmae production leaving jagged crescent sinuses along the lobe margins. **Sexual reproductive** structures not found on any plants in the collection.

**Diagnosis.** The plants readily key to *S. scandica* without much trouble using keys in both Schuster (1974, pp. 245-268, 363-365) and in Hong's treatment of western North American *Scapania* (Hong; 1980), and are a good fit to the published description (Schuster, 1974). Since *S. scandica* has not been previously reported from Oregon, or, for that matter, anywhere else in western North America below 48°N, it is prudent to carefully compare the specimen with descriptions of taxa that *are* known from southern Oregon, especially given Schuster's discouraging words about the lack of crispness in species boundaries for this taxon. It at first seemed to me the specimen might be conveniently shoehorned into any one of several taxa known to occur in the region. Given the breadth of descriptions in Schuster (1974), *S. mucronata*, *S. undulata* var. *oakseii*, and a dwarfed expression of *S. american* might all accomodate the specimen. Descriptions of several other taxa, including *S. helvetica*, *S. mucronata* var. *praetervisa*, *S. curta*, *S. ligulata*, and *S. parvifolia* were also considered in detail. After careful study of the specimen, however, it became apparent that, in spite of a broad overlap in phenotypic expression of the candidate taxa, none but *S. scandica* could adequately account for the particular constellation of characters observed.

Specifically, the specimen is immediatly separable from *S. mucronata* (including *S. mucronata* var. *praetervisa*) by a strong tendency in *S. scandica* for ventral leaf lobes to be broadly rounded rather than acute and +/- mucronate, for ventral leaf lobes to develop a reddish pigmentation basally, and by strong dentition of leaf lobes associated with gemmiparous shoots.

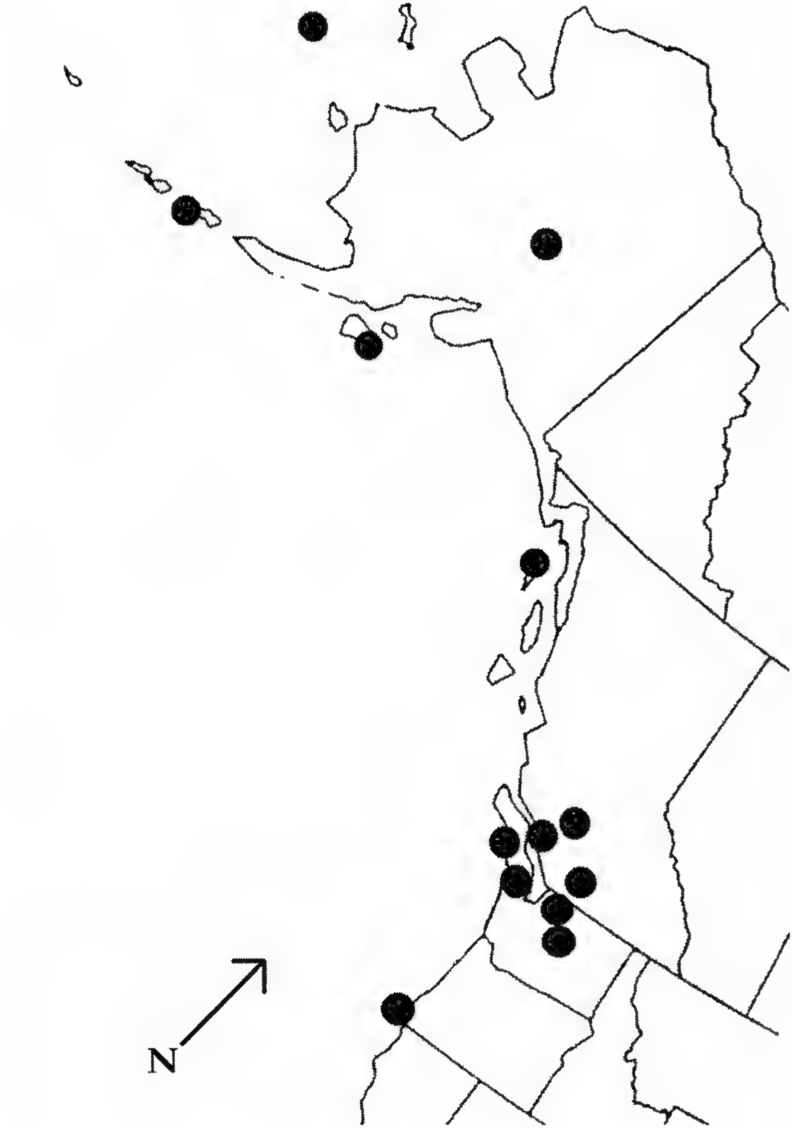
The specimen is separable from *S. undulata* by consistently transverse to short-decurrent insertion of ventral lobes, absence of distinctly differentiated cells bordering leaf lamina, the relatively large oil bodies obscuring most of the lumen, and presence of pronounced cuticular papillae. In addition, the specimen is distinct from *S. undulata* var. *oaksii* in the complete absence of a wing and teeth on the keel.

The specimen is separable from dwarf forms of *S. americana* by dorsal lobes clearly and consistently transversely inserted (not at all succubous), complete absence of paraphyllia, absence of dorsiventral differentiation of stem as seen in cross section, cortical cells that are neither flattened nor have wall thickness exceeding the lumen diameter, stems are deep red-brown, not blackish, and the terminal cell of leaf teeth are often 3-5x as long as wide (Schuster, 1974, pg. 586).

**Discussion.** Hong (1978a) included ten taxa of *Scapania* in his list of Oregon hepatics. Christy and Wagner (1996) report two additional taxa from Oregon. Overall, 25 taxa of *Scapania* are currently known from the Pacific Northwest defined as British Columbia, Washington, and Oregon (Godfrey, 1977; Godfrey & Godfrey, 1978; Godfrey & Schofield, 1979; Hong, 1978a, 1978b, 1980a, 1980b, 1981; Christy & Wagner, 1996). In published reports *S. scandica* is only documented in western North America from British Columbia and Alaska (Hong, 1989). A search of UBC herbarium records reveals several specimens that add significant detail to our knowledge of the range of *S. scandica* in the Pacific Northwest. The following representative collections documenting *S. scandica* in the Pacific Northwest are all in UBC. While these collections were not examined specifically for this report, the determinations are all on good authority.

**British Columbia:** Mt. Cheam, above Agassiz, ca. 49°15'N 121°40'W, *W.B. Schofield 76941*; Long Beach, Pacific Rim N.P., Vancouver Is., *J.D. Godfrey 2708*; Flower Ridge trail, Strathcona N.P., *J.D. Godfrey 1307*; Whistler Mt., *J.D. Godfrey 2107*; Joffre Mt., e. of Pemberton, *J.D. Godfrey 2085*; Elk Mt. trail, vic. Chilliwack, *J.D. Godfrey 1196*; vic. Lindeman Lake, Chilliwack River valley, *J.D. Godfrey 2605*. **Washington:** Washington Pass Bog, North Cascades, ca. 48°N 121°W, J. *Spence 1138*; Church Mt. trail, Mt. Baker Snoqualmie N.F., ca. 49°N 121°50'W, *J.D. Godfrey 2983.*

The known geographic range in the Pacific Northwest, including previously published reports (Hong, 1980) extends from Saint Matthew Island in the Bering Sea, eastward in the Aleutian Archipelago to Unalaska Island, from Kodiak Island in the Gulf of Alaska, mainland Alaska in the Alaska Range, southward in the Alexander Archipelago on Baronof Island, on Vancouver Island and the southern coast of British Columbia, inland in southern British Columbia at least as far as Joffre Mt. and in the Chilliwack River valley, south in the Western



Map 1. Pacific Northwest distribution of *Scapania scandica* based on published reports and select herbarium specimens in UBC.

Cordillera as far as the Northern Cascades in Washington, and at one isolated station on the southern Oregon coast (this report).

While the southern Oregon collection represents a substantial range extension, the occurrence of *S. scandica* on the Oregon coast is not unexpected. The Oregon coast and coastal mountains are known for the high incidence of species represented by populations at the southern limit of their range. Among hepatics, *Diplophyllum albicans*, *Diplophyllum plicatum*, *Kurzia makinoana*, and *Metzgeria temperata*, taxa with otherwise boreal or North Pacific Arc distributions, all occur as extreme southern populations on the immediate coast and near coastal mountains in Oregon and northern California (Christy & Wagner, 1996). Bryophytes associated with *Sphagnum* are particularly well represented among taxa range limits along the Oregon coast. *Calypogeia sphagnicola*, *Cephaloziella spinigera*, *Lophozia laxa*, *Pohlia sphagnicola*, and *Polytrichum strictum*, all primarily boreal plants associated with *Sphagnum*, reach the southern extremes of their distributions on the Oregon coast. Other rare bryophytes show up on the Oregon coast as long range disjuncts or local endemics presumably derived through long range founders. Included in this group are *Campylopus schmidii* and *Libella fryei.* Lichens demonstrate a similar pattern of attenuate distributions and disjunctions on the immediate coast of Oregon (McCune, Rosentreter & Debolt, 1997) where taxa such as *Anaptychia setifera* and *Bryoria bicolor* are found as isolated populations on rocky headlands and near-coast mountain tops.

In general, exposed rocky headlands and near-coast summits harbor the greatest concenrations of rare disjuncts and populations at the limits of geographic distribution. Many are primarily circumboreal with prominent range extensions southward at high elevations in the western cordillera, but a significant percentage reach their southern limit on the immediate coast. This pattern is perhaps nowhere more pronounced than on Saddle Mountain in Clatsop County, Oregon. Known disjunct hepatics there include *Lophozia barbata*, *Lophozia lycopodioides*, *Herbertus aduncus*, *Herbertus sakuraii*, *Plagiochila semidecurrens* var. *alaskana*, *Radula brunnea*, *Radula obtusiloba* ssp. *polyclada*, and *Tritomaria quinquedentata* (Christy & Wagner, 1996). Known disjunct populations of mosses on Saddle Mountain include *Encalypta brevipes*, *Iwatsukiella leucotricha*, and *Rhytidium rugosum*. Disjunct lichens there include *Sticta arctica*, *Bryoria bicolor*, *Hypogymnia duplicata*, and *Ochrolechia subplicans*. A similar concentration of disjunct lichens is reported from other near-coast summits and rocky headlands (McCune, Rosentreter & DeBolt, 1997). A similar pattern of near-coast disjuncts and range limits is repeated in Washington and British Columbia where, among other extreme pacific arc disjuncts, occur taxa such as *Takakia lepidozioides*, *Porella fauriei*, *Radula* *obtusiloba* ssp. *polyclada, Dendrobazzania griffithiana, Cololejeunea macounii* (Hong, 1987), and even *Sphenolobopsis* (Schofield, 1968). Detailed discussion and explication of Pacific coast biogeography of cryptogams is addressed in Schofield (1968, 1984), Hong (1987), and Norris (1997).

Oregon coast sea stacks have a combination of mesohabitat attributes and geographic position that endows them with the potential for a high incidence of rare taxa. Sea stacks are ancient remnants of headlands left standing isolated from the shore after surrounding rocks have eroded. The sea stack mesohabitat closely simulates summer climatic conditions obtaining at much higher latitudes and further inland at higher elevations. The rocky and cliffy mesohabitat of prominent headlands and sea stacks also provides a rich assemblege of microhabitats similar to those found in rocky and cliffy montane and alpine mesohabitats (Vitt & Belland, 1997). Sea stacks are thus predicted to harbor an unusually high concentration of rare cryptogams. These ancient fragments of landscape, climatically buffered by their isolation from the mainland and relatively immune from human disturbances, are consequently likely targets in a search for rare cryptogams. Taxa distributed primarily at high latitudes find a narrow zone of suitable habitat extending southward along the coast, and once established, given the relative stability of the mesohabitat, are likely to persist. While some of the rare disjuncts may have arrived by long distance dispersal, it seems likely that others persist as relicts in a narrow refugial zone following the post-pleistocene retreat of a broad periglacial climatic belt.

Significant concentrations of rare cryptogams have come to light in recent years through a search of on-shore sites having some of the attributes of sea stacks. It seems likely that additional rarities await discovery on prominent sea stacks as well. Most are perhaps confined to specific microhabitats that are both spatially fragmented and restricted in area, and only a small percentage of such available sites can be expected to harbor colonies of rare taxa. The logistical difficulties and significant perils encountered in searching and retrieving specimens from cliffs and ledges on sea stacks, however, does not bode well for their quick and easy discovery. Among sea cliff sites harboring rare taxa, only a small percentage will ever be accessible for collection. Though a few new taxa, such as *Scapania scandica*, will turn up periodically, most will certainly remain undiscovered for a long time to come. Nevertheless, a concerted effort to study cryptogams of west coast sea stacks and rocky headlands promises to be highly rewarding.

**Acknowledgements.** I wish to thank Southern Oregon University for a series of grants supporting development of a photomicrography facility at the SOU Herbarium, and for generous provision of the server space needed to host bryophyte image pages. Thanks are also extended to Dr. Wilf Schofield, Dr. Judith Godfrey and Dr. John Spence for permission to document their unpublished collections.

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## *Leucocarpia biatorella* (Verrucariaceae), new to North America

**William R. Buck and Richard C. Harris**

The annual meeting of The American Bryological and Lichenological Society for 2001 was held in Albuquerque, New Mexico, in conjunction with Botany 2001. The Society sponsored two pre-meeting field trips, the first, a two-day trip into the Sangre de Cristo Mountains, east of Santa Fe, and the other a one-day trip into the Sandia Mountains, east of Albuquerque. In both trips we got to well over 3000 m, into alpine vegetation, much unlike the stereotypic desert that one envisions to blanket New Mexico. During these trips, three collections were made which represent a pyrenolichen new to North America.

*Leucocarpia biartorella* (Arnold) Vězda

NEW MEXICO. **Santa Fe County:** Santa Fe National Forest, Sangre de Cristo Mountains, Tesuque Peak, end of road to radio towers from Aspen Vista Picnic Area, 3630 m, 35°47'08"N, 105°46'53"W, alpine zone with scattered *Picea engelmannii* and *Abies lasiocarpa*, on moss, 10 August 2001, *William R. Buck 39721* (NY 532070); **Bernalillo County:** Sandia Mountains, Cibola National Forest, Sandia Crest, along North Crest Trail no. 130N, 3250 m, 35°12'39"N, 106°26'57"W, aspen-conifer forest, on moss on decaying log, 12 August 2001, *William R. Buck 39856* (NY 532096), *39863* (NY 532099).

*Leucocarpia* is a monotypic genus (Vězda 1969). Although some workers have placed other species in the genus, none has remained except the type. It has previously been reported from Scotland (Coppins 1992), Austria, Slovakia (Vězda 1969), Sweden (Santesson 1993), and Finland (Vitikainen et al. 1997). It is apparently rare throughout its range. However, the lichen is exceedingly inconspicuous and the few collections may more be a result of oversight than actual rarity.

*Leucocarpia biatorella* may be characterized by a thinly granular-verrucose, greenish thallus often growing over bryophytes, with immersed, pale perithecia only about 0.5 mm in diameter and pale pink to yellow ostioles. The periphyses are 60–70 × 1 µm. The ascospores are 8/ascus, ellipsoid, hyaline, and muriform, 24–31 × 8–12 µm (in our material, reportedly sometimes slightly larger in Europe). The spores are initially 3-septate, but soon become muriform with 7–8(9) transverse septa. Conidia are unknown and no lichen products are detected by TLC (Coppins 1992).

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In North America *Leucocarpia* is most likely confused with *Chromatochlamys muscorum* (Fr.) Mayrh. & Poelt, also forming thin thalli over bryophytes, but in that species there are numerous paraphyses (as opposed to none in *Leucocarpia*) and larger ascospores (mostly 2–4/ascus and 60–110 × 20–27 μm).

Acknowledgments. We thank Bob Egan and Tom Nash, who led the 2001 ABLS field trips, and The New York Botanical Garden, for financial subsidy of WRB's trip.

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# Bryophytes of the Interior Highlands of North America: Arkansas and Missouri New County Records plus Corrections

**Carl E. Darigo**[1]

This paper reports on new county records for bryophytes of the Interior Highlands of North America (Arkansas and Missouri), plus corrections to a recent paper.

The Interior Highlands of North America, divided into several topographic regions, includes the southern portion of Missouri, much of Arkansas, a small section of southern Illinois and extends along the eastern border of Oklahoma.

CORRECTIONS to (Darigo 2001)

1. Delete BRYACEAE, *Bryum capillare* Hedw. var. *capillare*, Taney: Hercules Glades Wilderness, Darigo 3638.
2. Under PORELLACEAE, *Porella pinnata* L., Brant 4679, change Iron: Bell Mountain Wilderness to Bollinger: Castor River.

New moss county records were distributed as follow:
MISSOURI--17
  Border Counties (1): Lincoln-1
  St. Francois Mountains (6): Iron-6
  Salem Plateau (9): Bollinger-1, Butler-1, Franklin-1, Jefferson 1, Phelps-1, St. Francois-1
  St. Louis-1, Ste. Genevieve-2
  Springfield Plateau (1): Greene-1
ARKANSAS--12
  Boston Mountains (12): Franklin-2, Madison-7, Newton-3

Specimens were verified by Bruce Allen. The basis for existing Interior Highlands moss county record data is Redfearn (2000). All collections are deposited at MO. Missouri county records are indicated by county name only, while Arkansas records are identified by county and state abbreviation.

MOSSES
AMBLYSTEGIACEAE

*Leptodictyum riparium* (Hedw.) Warnst.-*laxirete expression* Ste. Genevieve: Morrison Hollow, NW of Bloomsdale Summers et al 9744. Occurs in flowing water with leaves somewhat more erect than complanate, resembling *Fontinalis* Hedw.

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*Platylomella lescurii* (Sull. *in* Gray) Andrews Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22294.

ANOMODONTACEAE

*Herpetineuron toccoae* (Sull. & Lesq. *in* Sull.) Card. Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22309.

BARTRAMIACEAE

*Philonotis fontana* (Hedw.) Brid. var. *fontana* Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22286.

BRACHYTHECIACEAE

*Homalotheciella subcapillata* (Hedw.) Broth. Franklin: Meramec State Park, D. Darigo 10. Greene: E of James River & S of Lake Springfield Dam, Allen & Magill 4687. Jefferson: Parker Creek near Big River, Allen et al 7484.

DICRANACEAE

*Dicranella heteromalla* (Hedw.) Schimp. Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22308.

DITRICHACEAE

*Pleuridium subulatum* (Hedw.) Rabenh. Iron: Royal Gorge, Allen 23016. First report for St. Francois Mountains Region of Interior Highlands.

FISSIDENTACEAE

*Fissidens adianthoides* Hedw. Newton-AR: Steel Creek, Buffalo National River, Allen 22331.

*F. bushii* (Card. & Thér.) Card. & Thér. Franklin-AR: Spy Rock Hollow, Ozark National Forest, Allen 22242.

*F. fontanus* (B. Pyl.) Steud. Bollinger: Castor River, Brant 4678.

*F. obtusifolius* Wils. var. *obtusifolius* Ste. Genevieve: Morrison Hollow, NW of Bloomsdale, Darigo 3672.

F. *subbasilaris* Hedw. Iron: Royal Gorge, Allen 23014.

FONTINALACEAE

*Fontinalis novae-angliae* Sull. var. *latifolia* Card. Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22273.

*F. sphagnifolia* (C. Müll.) Wijk & Marg. Franklin-AR: Spy Rock Hollow, Ozark National Forest, Allen 22229. Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22283.

MNIACEAE

*Plagiomnium rostratum* (Schrad.) T. Kop. Newton-AR: Gene Rush/Buffalo River Wildlife Management Area, Allen 22347.

POLYTRICHACEAE

*Atrichum altecristatum* (Ren. & Card.) Smyth & Smyth Iron: Royal Gorge, Allen 23023. First report for St. Francois Mountains Region of Interior Highlands.

*A. oerstedianum* (C. Müll.) Mitt. Madison-AR: White Rock Wildlife Management Area, Ozark National Forest, Allen 22282.

*Pogonatum brachyphyllum* (Michx.) P. Beauv. Iron: Royal Gorge, Allen 23024. First report for St. Francois Mountains Region of Interior Highlands.

POTTIACEAE

*Weissia sharpii* Anderson & Lemmon St. Louis: Tyson Research Center, Darigo & Darigo 3668. Newton-AR: Gene Rush/Buffalo River Wildlife Management Area, Allen 22361.

PTYCHOMITRIACEAE

*Ptychomitrium drummondii* (Wils.) Sull. Iron: Royal Gorge, Allen 23017.

*P. sinense* (Mitt.) Jaeg. Butler: Hwy 60, 3 miles E of Hwy 67, Redfearn 26329. Iron: Royal Gorge, Allen 6338. Both of these collections were originally named *P. incurvum* (Schwaegr.) Spruce. and were annotated as *P. sinense* by William Reese in 1995. *Ptychomitrium sinense* has been reported only once previously in Missouri and is listed as S1-critically imperiled (Anonymous 2001).

SELIGERIACEAE

*Seligeria calcera* (Hedw.) Bruch & Schimp. *in* B.S.G. Lincoln: Cuivre River State Park, Norris 63-78. The specimen was annotated by Dale Vitt, 1975. *Seligeria calcera* is known from only four counties in Missouri and is listed as S?-unranked (Anonymous 2001).

SPHAGNACEAE

*Sphagnum lescurii* Sull. *in* Gray St. Francois: SE of Doe Run, Summers et al 9542.

THUIDIACEAE

*Cyrto-hypnum pygmaeum* (Schimp. *in* B.S.G.) Buck & Crum Phelps: Yelton Spring, Mark Twain National Forest, Allen 22218.

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# Additions to the lichen flora of North America ??. *Agonimia allobata* and *Aspicilia grisea*

**Alan M. Fryday**[1]

**Abstract.** Agonimia allobata *and* Aspicilia grisea *are reported for the first time from North America from Michigan U.S.A.*

In the summer of 2000, my son and I collected a corticolous, pyrenocarpous lichen from Wilderness State Park (Emmet Co., Michigan), which on subsequent examination proved to be *Agonimia allobata.* Also, during the preparation of the recent checklist of lichens and allied fungi from Michigan (Fryday *et al.* 2001) a specimen was discovered in the herbarium of the University of Michigan (MICH), collected from Laughing Whitefish Point (Alger Co., Michigan) and filed under 'soraliate, saxicolous crust', that was a specimen of *Aspicilia grisea.* As these taxa are not listed in recent North American Checklists (Esslinger 1997, Esslinger & Egan1995) or, to my knowledge, in any other publication dealing with North American lichens, I consequently believe that these are the first records of these species for North America.

**Agonimia allobata (Stizenb.) P. James – U.S.A., Michigan,** Emmet Co., Wilderness State Park, Big Stone bay, 45° 44' 47"N 84° 54' 28"W, on trunk of coniferous tree at west end of beach campground, 18 August 2000, *A.* (8025) *& K. Fryday* (MSC).

The species of *Agonimia* are characterized by having a minutely squamulose to granular thallus, with the cortical cells baring short papillae (Purvis 1992, Dobson 2000). *Agonimia allobata* is atypical in that the thallus is often smooth, although the Michigan specimen had well-developed thalline squamules. *Agonimia allobata* has hyaline, muriform, ascospores 30-35 x 10-15μm. The only other species of *Agonimia* recorded from North America have larger ascospores (30-60μm long in *A. gelatinosa*, and 60-120μm long and only 2-spored asci in *A. tristicula*). The recently described *A. repleta* (Czarnota & Coppins 2000), known only from Europe has similar sized ascospores as *A. allobata*, but is distinguished from it by having a smooth perithecium wall.

*Agonimia allobata* appears to be widespread, but rare, in Europe, having been recorded from the British Isles, France, Germany, Italy, Spain, Norway, Sweden,

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Switzerland, and the Czech and Slovak Republics. The North American specimen was collected from a tree in a campground by the author and his one year-old son, Konrad, who while being carried around the campground, quickly leaned the technique of removing pieces of bark from trees and putting them in his father's shirt pocket. It is remarkable that this first record of *A. allobata* from North America was made in such a casual manner in an area that was, for many years, the haunt of the notable collector of pyrenocarpous lichens, Richard C. Harris!

The identity of the phorophyte of the North American specimen is uncertain but, as records from Europe are usually from deciduous trees, it was almost certainly a member of the Cupressaceae, which have a relatively basic bark pH, and most probably *Thuja occidentalis* (Northern White Cedar), although *Juniperus virginiana* (Eastern Red Cedar) was also present at the collection site.

**Aspicilia grisea Arnold – U.S.A., Michigan,** Alger Co., Deerton, Laughing Whitefish Point, [46°32'N 87°01'W], on shore rocks, June 17 1933, *J. L. Lowe* 2475 (MICH).

This collection was originally identified by J. Hendrick as *Pertusaria velata* (Turner) Nyl. However, that species is now known to be non-sorediate, corticolous, and has a thallus containing lecanoric acid (C+ red, K-), whereas the present specimen is sorediate, occurs on siliceous rock, and contains only norstictic acid (C-, K+ red). It was annotated "not a *Pertusaria*" by M. Dibben in 1972 and re-filed under "soraliate saxicolous crust".

The specimen agrees well with European collections and descriptions (e.g. Foucard 1990, Fryday & Coppins 1997, Purvis & Coppins 1992) in having a lead-grey, areolate thallus with a white prothallus and pale-grey to cream colored, granular soralia that are initially punctiform but coalesce to cover larger areas. Apothecia are absent from the Michigan collection and rare in European material. Even when present, mature asci or ascospores are rarely produced.

*Aspicilia* is badly in need of a modern taxonomic revision. The current North American checklist (Esslinger 1997) lists over 60 species of *Aspicilia* but, as far as I can ascertain, only *A. mastrucata* (Wahlenb.) Th. Fr., which has a granular thallus and is usually fertile, is both sorediate and has a thallus containing norstictic acid.

*Aspicilia grisea* was previously only known from northern and central Europe and its discovery in northern Michigan suggests it is probably an overlooked, circumboreal species.

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# *Calicium corynellum* (Ach.) Ach. in the United States, and *Calicium montanum* Tibell new for North America

**Annette Kolb[1] and Toby Spribille[2]**

*Calicium corynellum* (Ach.) Ach. is one of the few calicioid lichens, and the only one of its genus, that occurs almost exclusively on rock. It is widespread but rare throughout Europe from Fennoscandia to Italy (Purvis et al. 1992, Nimis 1993, Wirth 1995, Türk et al. 1998, Tibell 1999a). The first North American report of the species was based upon a single specimen collected under overhanging siliceous rocks in Wells Gray Provincial Park in central British Columbia (Tibell 1975). It appears to have a western North American – western Eurasian distribution pattern, a pattern which is being found to be common with many lichen species.

*Calicium corynellum* has turned up in widely scattered localities in the western United States over the past 20 years. Wetmore (unpubl. 1985) reported this species from Sequoia National Park, California, and two years later (unpubl. 1987) from Saguaro National Monument, Arizona. Based on the latter collection, Goward (1999) included Arizona in the range of the species. Other than Goward's report, there have been no published reports of *C. corynellum* from the United States.

This species came to our attention through the discovery of a series of locations for it in northwestern Montana. Subsequently, we have had the opportunity to study all of the known American material of *Calicium corynellum.* In addition to its occurrence in British Columbia, we are able to verify its occurrence in California, Idaho and Montana.

*Calicium corynellum* bears a superficial resemblance to the more common corticolous species *Calicium viride* Pers.. Like *C. viride*, it bears a brownish excipulum and a yellowish-green thallus. However, it differs from *C. viride* in that the thallus is granular to leprose, not granular to verrucose, in the ascomata, which can be lightly yellowish-pruinose and are shorter (0.5 to 0.6 mm instead of more than 1 mm high in typical *C. viride*), and in its occurrence on rock (Tibell 1999a). In Europe the species has been reported to be parasitic on *Haematomma ochroleucum* (Nimis 1993, Wirth 1995) and possibly on species of *Lepraria* (Purvis et al. 1992).

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*Calicium corynellum* is undoubtedly more common than the few reported records would seem to indicate. At first glance, the ascomata are not evident, giving the impression of little more than a yellowish leprose crust, and for this reason it may be frequently overlooked. The habitat conditions in which we found the Montana material were not particularily unique. The lichen tends to occur under siliceous rock overhangs, where sheltered from direct rain, but often in localities which are otherwise quite humid, as along rivers. It is often associated with other leprose lichen species, in particular *Leproloma membranaceum.*

Specimens examined: U.S.A.. **California**. Tulare Co., Sequoia National Park, north end of Log Meadow, under rock overhang, *Wetmore 50433* (MIN); **Idaho**. Boundary Co., Upper Priest Falls on Priest River, 1 km S of British Columbia border, ca. 950-1050m, 49°00'N, 116°55'W, *Spribille 11176* (herb. Spribille); Kootenai Co., North Fork Coeur d'Alene River on ledges of vertical face of outcrop, on east-facing talus slope, 730m, 47°38'N, 116°22'W, *McCune 21035* (OSC); **Montana**. Flathead Co., 5 km west of Columbia Falls, Columbia Mtn. trail, on rock outcrops, 930m, 48°22'30"N, 114°07'30"W, *Spribille 10916* (herb. Spribille); Lincoln Co., Stillwater River, along road to Mt. Marston, ca. 2km NE of Stryker, 1040m, 48°41'N, 114°45'W, *Kolb 196* (herb. Kolb, herb. Spribille, UPS); Lincoln Co., Western Cabinet Range, Keeler Creek, 785m, 48°20'N, 115°54'W, *Spribille, Goward & Arvidson 10385* (UBC); Lincoln Co., Western Cabinet Range, Ross Creek cedars, in rocks above grove, 915m, 48°12'30"N, 115°55'W, *Spribille & Goward 10635* (herb. Spribille).

The Arizona material labelled as *Calicium corynellum* was collected from the wood of alligator juniper (*Juniperus deppeana* Steud.), an anomalous substrate for *C. corynellum*, and the thallus differs from typical *C. corynellum* in its greenish-gray, corticate-verrucose granules. The specimen was determined by L. Tibell (UPS) to be *Calicium montanum* Tibell, a recently described species known hitherto only from southern Europe and the Alps (Tibell 1999b). A detailed description and illustrations of *C. montanum* are provided by Tibell (1999b). It is new for North America. *C. montanum* differs from *Calicium viride* in the greenish-gray thallus, in the shorter ascomata (0.3-0.4 mm), and in that the outer surface of the excipulum bears a distinct white pruina.

Specimen examined: U.S.A.. **Arizona**. Pima Co., Saguaro National Monument, Rincon Mt. Section, Cow Head Saddle, *Wetmore 54868* (CANL, MIN).

**Acknowledgments.** Thanks are extended to L. Tibell, Uppsala University, Sweden for looking at some of our material and the Arizona specimen, and to the curators of the herbaria CANL, MIN, and OSC for loans of specimens.

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# An improved miniprep method of DNA extraction for bryophytes.

**James Bray Jr. & Kelsi Scott**

**Abstract**. A rapid miniprep DNA extraction method was developed for bryophytes. This method uses very small amounts of plant material, with a typical extraction of 3 mg of tissue yielding an average of 25 ng/µl of DNA. Advantages of the method are that no extremely hazardous chemicals are used and the extraction can be completed in one hour. This method should be broadly applicable when study material is limited and is well suited for classroom use due to safety, speed of extraction and cost savings.

**Introduction.** In addition to classical approaches, the development of molecular methods to infer systematic relationships are a necessity to modern monography. Isozyme analysis, random amplified polymorphic DNA (RAPDs) and most recently direct loci sequencing are commonly used methods at the species level. In some groups, species boundaries can often be discerned with isozyme variation but others require more direct gene level assessment. In these instances, DNA extraction for RAPDs analysis or direct loci sequencing is warranted. In bryophytes, like the simple thalloid liverwort *Fossombronia* Raddi, sample size is often very small, making many standard DNA extraction procedures inapplicable. Therefore, the employment of miniprep extraction methods has been necessary for our molecular studies.

A number of miniprep DNA extraction methods have been developed in recent years (Dellaporta et al. 1983; Doyle & Dolye 1987; Edwards et al. 1991; Goffinet et al. 1998; Timme & Ross 1997; Yoon et al. 1992). Most of them call for at least 0.1g of tissue and experimenting with these techniques to extract DNA from *Fossombronia* yielded unsatisfactory results. Highly variable amounts of DNA were extracted with a modification of the phenol/chloroform method of Dellaporta et. al (1983), but these extractions failed to produce repeatable PCR products with random primers because the quality of the DNA was poor. In order to improve the quantity and quality of the extract, a miniprep extraction buffer and protocol were developed specifically for this liverwort. With safety as a major concern, the use of potentially harmful chemicals, as called for in most extraction methods, was avoided. In addition to the health risk, the expense of some chemicals prohibit many smaller institutions from carrying out such research. Thus, our goal was to develop a safe, quick and inexpensive method of DNA extraction that works well in the bryophytes and should be applicable to other cases where plant material is limited.

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**Materials and Methods.** Both field material and axenic cultures of various *Fossombronia* species as well as axenic cultures of *Pellia* Raddi, *Pallavicinia* Gray and field collections of *Anomodon attenuatus* (Hedw.) Huebener, *A. minor* (Hedw.) Fürnr, *A. rostratus* (Hedw.) Schimp. and *Hypnum imponens* Hedw. were used to test the effectiveness of the method. All samples were vouchered at the time of collection and are deposited in ABSH.

Prior to DNA extraction, soil, field debris and agar were removed as necessary using a dissecting microscope. Double stranded, genomic DNA was extracted from the cleaned plants as follows:

1. A 1.5 ml sterile microcentrifuge tube and disposable grinding rod were cooled in liquid nitrogen just prior to adding plant material.
2. Either 3 mg of gametophyte plant material or 5 brown, sporophyte capsules was placed in the tube and covered with liquid nitrogen. After the nitrogen evaporated, the tissue was ground to a fine powder. This was repeated 2 or 3 times depending on the toughness of the material.
3. The tissue was then ground for 1 minute with 300 µl of extraction buffer and allowed to sit at room temperature for 10 minutes. The extraction buffer consists of 125 mM Tris, 50 mM NaEDTA, 250 mM NaCL, 1% wt/vol SDS & 0.1% wt/vol PVP-40). The buffer is prepared by mixing (in order) 151 mg Tris (base), 186 mg EDTA (disodium, dihydrate), 146 mg NaCL, 100 mg SDS and 10 mg PVP-40 in 10 ml of autoclaved, nanopure water. The final pH of the solution is ca. 8.2 and the buffer should not be autoclaved.
4. The buffer/extract mix was cold centrifuged for 15 minutes at 10,000 rpm.
5. The supernatant was transferred to a clean 1.5 ml tube and 300 µl of cold isopropanol was added. This was allowed to sit at room temperature for 10 minutes.
6. The supernatant/isopropanol mix was cold centrifuged for 15 minutes at 10,000 rpm to precipitate the nucleic acids.
7. The supernatant was decanted, taking care not to disturb the pellet.
8. The pellet was allowed to air dry overnight or was vacuum dried.
9. The pellet was resuspended in 25 µl of autoclaved nanopure water and allowed to sit at room temperature for 1 hour.
10. To remove RNA, 1.5 µl of RNase (1µl/ml) was added and the mixture was incubated at 37° C for 30 minutes.
11. To test for purity, 5 µl of DNA was mixed with 5 µl of glycerol loading dye. This was run on a 1.4% agarose gel to determine DNA and RNA presence. A single high molecular weight band (greater than 12.2 Kb) indicated the presence of DNA and lower molecular weight bands (between 2 and 3 Kb) indicated the presence of residual RNA.
12. If RNA was still present, steps 10 and 11 were repeated until all residual RNA was removed.

Stock DNA directly from extraction can be stored at -80° C indefinitely. Quantified, diluted DNA (3 ng/µl) can be stored in small tubes at -20° C for future use or at 4° C for immediate use. Extracted DNA is best aliquotted into several small tubes so samples can be removed without repeated thawing and freezing which degrades DNA.

**Discussion.** The protocol outlined above typically yielded an average of 25 ng/µl of DNA from 3 mg of tissue, as compared to a typical yield of 25 ng/µl of DNA from 100mg or more with other methods. Repeatable RAPDs amplification products were obtained with 3ng/µl DNA concentration, with a total DNA content of 9 µl in each PCR reaction mix. In addition to reliable results with minimal tissue, the time to complete an extraction to the point of drying is less than one hour, as compared to a minimum of three hours with most other methods. Timme and Ross (1997) outlined a method that takes a relatively short time, but as written did not work in our laboratory. By discarding the supernatant without either an isopropanol or ethanol precipitation step, as they describe, the DNA would be discarded with the supernatant. If, by chance, any DNA was retrieved with this method, it would be obscured by numerous proteins, along with cellular debris, and would be very hard to clean for use in PCR.

Perhaps the most important advantage of our method is the elimination of mercaptoethanol and CTAB from the grinding buffer and chloroform from the protocol. The omission of these chemicals reduces the overall cost and makes this method applicable to classroom use. The ease of extraction, safety and cost savings should be welcome in any classroom covering DNA extraction methods.

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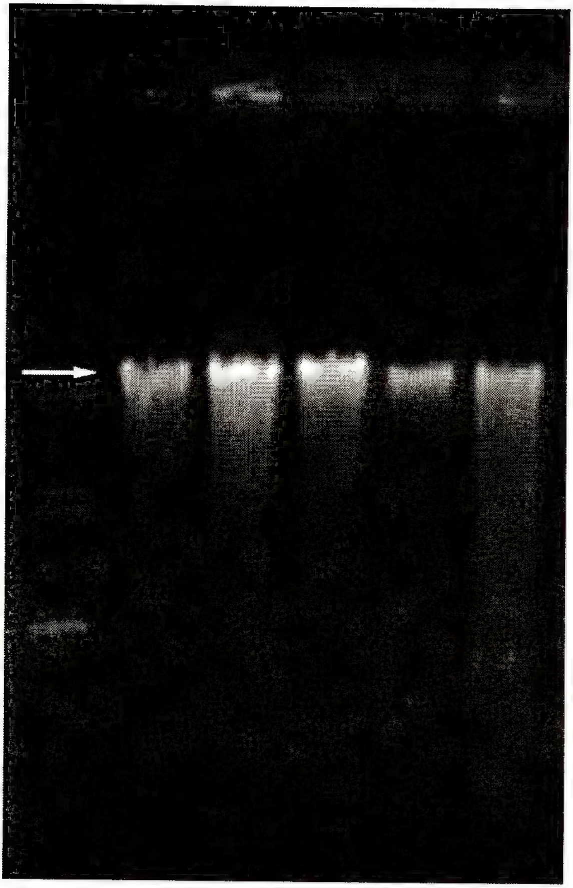

Figure 1. Agarose gel showing the presence of DNA from extraction. The DNA band is indicated by an arrow.

# Mosses of Simcoe County, Ontario

Frank S. Cook[1]

**Abstract:** Two hundred and thirty-nine moss taxa are listed from Simcoe County, Ontario. Seventy-two of them have not been reported before.

Simcoe County is located in south-central Ontario, Canada approximately between latitude 44° 15' N and 44° 50' N and longitude 79° 10 ' W and 80° 15 ' W. It has an area of 474,272 hectares and a population of 329,865 (1996). Main urban areas are Barrie, Orillia and Collingwood. The southern part of the County is dominated by the fertile valleys of the Nottawasaga River and its tributaries and the Holland River and is mainly agricultural. The exposed limestone of the Niagara Escarpment forms the highest points in the western reaches of the county. The north extends to the outcrops of the Precambrian Shield and is drained by the Severn River. To the east, part of the Carden limestone alvar is exposed. The county also includes extensive stretches of Georgian Bay and Lake Simcoe shorelines. Remnant patches of Great Lakes-St. Lawrence deciduous forest are found throughout the area, particularly in the north. Important wetlands include the remains of the Holland Marsh, Matchedash Bay and Tiny and Wye Marshes. The internationally significant Minesing Swamp, one of the largest in Ontario, is centrally located in the county and is drained by the Nottawasaga River. String fen complexes are a feature of the swamp. Northern acidic bogs may be found within the extensive wetlands in the northern reaches of the county. (I.T. Cook).

The following list of mosses is derived from four sources:

**IC** - Those listed from Simcoe County in the Checklist of the Mosses of Ontario by R.R. Ireland and R.F. Cain (1975).

**IL** - Those mapped for Simcoe County in the Atlas of Ontario Mosses by R.R. Ireland and L.M. Ley. (1992).

**FC** - Those collected by F.S. Cook to date. New county records have a collection number.

**TRTC** - Those in the collection of the Royal Ontario Museum and determined by Joan Crowe. (These were collected from The Minesing Swamp).

Except as noted below, the nomenclature is according to Anderson, Crum and Buck (1990) and *Sphagnum* to Anderson (1990). *Grimmia longirostris* Hook. and *G. muehlenbeckii* Schimp. were determined by J. Munoz. *Brachythecium laetum* (Brid.) B.S.G. is according to Robinson and Ignatov (1997)

[1] 18 Craig Cr., Barrie, Ontario. L4N 5X2.

*Abietinella abietina* (Hedw.) Fleisch. IC IL FC TRTC
*Aloina brevirostris* (Hook. & Grev.) Kindb. IC IL
*Amblystegium serpens* (Hedw.) B.S.G. IC IL FC
*Amblystegium varium* (Hedw.) Lindb. IC IL FC
*Anomodon attenuatus* (Hedw.) Hüb. IC IL FC TRTC
*Anomodon minor* (Hedw.) Fürnr. FC 5326
*Anomodon rostratus* (Hedw.) Schimp. IC IL FC
*Anomodon rugelii* (C. Müll.) Keissl. TRTC
*Anomodon viticulosus* (Hedw.) Hook. & Tayl. IC IL FC
*Atrichum altecristatum* (Ren. & Card.) Smyth & Smyth IL FC
*Atrichum oerstedianum* (C. Müll.) Mitt. FC 5629
*Atrichum tenellum* (Röhl.) B.S.G. FC 5729
*Aulacomnium palustre* (Hedw.) Schwaegr. IC IL FC TRTC
*Barbula convoluta* Hedw. IC IL FC
*Barbula unguiculata* Hedw. IC IL FC
*Bartramia pomiformis* Hedw. IC IL FC
*Brachythecium acuminatum* (Hedw.) Aust. IL FC
*Brachythecium calcareum* Kindb. IC IL FC
*Brachythecium campestre* (C. Müll.) B.S.G. IL FC
*Brachythecium digastrum* C. Müll. & Kindb. *in* Mac. & Kindb. FC 5876
*Brachythecium erythrorrhizon* B.S.G. FC 5771
*Brachythecium laetum* (Brid.) B.S.G. = *B. oxycladon* IC IL FC TRTC
*Brachythecium* oedipodium (Mitt.) Jaeg. FC 5318 TRTC
*Brachythecium populeum* (Hedw.) B.S.G. IC IL FC
*Brachythecium reflexum* (Starke *in* Web. & Mohr) B.S.G. IC IL FC TRTC
*Brachythecium rivulare* B.S.G. FC 5330
*Brachythecium rutabulum* (Hedw.) B.S.G. IC IL FC TRTC
*Brachythecium salebrosum* (Web. & Mohr) B.S.G. IC IL FC
*Brachythecium turgidum* (Hartm.) Kindb. IC IL FC
*Brachythecium velutinum* (Hedw.) B.S.G. IC IL FC
*Brotherella recurvans* (Michx.) Fleisch. IL FC
*Bryhnia graminicolor* (Brid.) Grout IL FC
*Bryhnia novae-angliae* (Sull. & Lesq. *in* Sull.) Grout IC IL FC
*Bryoerythrophyllum recurvirostre* (Hedw.) Chen IL FC TRTC
*Bryohaplocladium microphyllum* (Hedw.) Wat. & Iwats. FC 4837
*Bryum algovicum* Sendtn. *ex* C. Müll. FC 5293
*Bryum argenteum* Hedw. IL FC
*Bryum caespiticium* Hedw. IC IL FC TRTC
*Bryum flaccidum* Brid. FC
*Bryum lisae* De. Not. *var. cuspidatum* (B.S.G.) Marg. FC 5213
*Bryum pseudotriquetrum* (Hedw.) Gaertn et al IC IL FC TRTC
*Callicladium haldanianum* (Grev.) Crum IC IL FC TRTC
*Calliergon cordifolium* (Hedw.) Kindb. IC IL FC
*Calliergon giganteum* (Schimp.) Kindb. IC IL FC TRTC
*Calliergon richardsonii*(Mitt.) Kindb. *in* Warnst. FC 5145
*Calliergon stramineum* (Brid.) Kindb. TRTC
*Calliergonella cuspidata* (Hedw.) Loeske IC IL FC TRTC
*Campylium chrysophyllum* (Brid.) J. Lange IC IL FC TRTC

*Campylium hispidulum* (Brid.) Mitt. IC IL FC TRTC
*Campylium polygamum* (B.S.G.) C. Jens. IL FC
*Campylium stellatum* (Hedw.) C. Jens. IC IL FC TRTC
*Catoscopium nigritum* (Hedw.) Brid. IL
*Ceratodon purpureus* (Hedw.) Brid. IC IL FC TRTC
*Cirriphyllum piliferum* (Hedw.) Grout FC 5580
*Climacium americanum* Brid. IC
*Climacium dendroides* (Hedw.) Web. & Mohr IC IL FC TRTC
*Conardia compacta* (C. Müll.) Robins. FC 4770
*Cratoneuron filicinum* (Hedw.) Spruce IC IL FC
*Cyrto-hypnum minutulum* (Hedw.) Buck & Crum FC 4893
*Dichelyma pallescens* B.S.G. IL
*Dicranella heteromalla* (Hedw.) Schimp. IC IL FC
*Dicranella schreberiana* var. *robusta* (Schimp. *ex* Braithw.) Crum & Anderson FC 5738
*Dicranella varia* (Hedw.) Schimp. IL FC
*Dicranum flagellare* Hedw. IC IL FC TRTC
*Dicranum fulvum* Hook. FC 5236
*Dicranum fuscescens* Turn. TRTC
*Dicranum montanum* Hedw. IL FC TRTC
*Dicranum ontariense* Peters. FC 4932
*Dicranum polysetum* Sw. IC IL FC TRTC
*Dicranum scoparium* Hedw. IC IL FC TRTC
*Dicranum undulatum* Brid. IL FC TRTC
*Dicranum viride* (Sull. & Lesq. *in* Sull.) Lindb. IC IL FC TRTC
*Didymodon fallax* (Hedw.) Zand. IL FC
*Didymodon rigidulus* Hedw. FC 5656
*Distichium capillaceum* (Hedw.) B.S.G. FC 4769 TRTC
*Ditrichum flexicaule* (Schwaegr.) Hampe IL FC
*Ditrichum lineare* (Sw.) Lindb. FC 5351
*Ditrichum pusillum* (Hedw.) Hampe IC IL FC
*Drepanocladus aduncus* (Hedw.) Warnst. IC IL FC
*Drepanocladus capillifolius* (Warnst.) Warnst. IC IL FC
*Encalypta procera* Bruch. IC IL FC
*Entodon cladorrhizans* (Hedw.) C. Müll.) IL FC
*Entodon seductrix* (Hedw.) C. Müll. IC IL FC
*Ephemerum cohaerans* (Hedw.) Hampe IC IL
*Ephemerum crassinervium* (Schwaegr.) Hampe FC 4785
*Eurhynchium hians* (Hedw.) Sande Lac. IC IL FC
*Eurhynchium pulchellum* (Hedw.) Jenn. IC IL FC TRTC
*Fissidens adianthoides* Hedw. IC IL FC TRTC
*Fissidens bryoides* Hedw. FC 5468
*Fissidens dubius* P. Beauv. IC IL FC TRTC
*Fissidens grandifrons* Brid. FC 5030
*Fissidens osmundioides* Hedw. FC 5666
*Fissidens taxifolius* Hedw. IC IL FC
*Fontinalis antipyretica* Hedw. IC

*Fontinalis hypnoides* Hartm. IL
*Fontinalis novae-angliae* Sull. IC
*Funaria hygrometrica* Hedw. IC IL FC
*Grimmia anodon* B.S.G. IL
*Grimmia longirostris* Hook. = *G. affinis* Hoppe & Hornsch .*ex* Hornsch. IC IL
*Grimmia muehlenbeckii* Schimp. FC 5479
*Grimmia pilifera* P. Beauv. IC IL
*Grimmia plagiopodia* Hedw. IL
*Grimmia unicolor* Hook. *in* Grev. IC IL
*Gymnostomum aeruginosum* Sm. FC 5710
*Hamatocaulis vernicosus* (Mitt.) Hedenäs = *Drepanocladus vernicosus* (Mitt.) Warnst. TRTC
*Hedwigia ciliata* (Hedw.) P. Beauv. IC IL FC
*Helodium blandowii* (Web. & Mohr) Warnst. IC IL FC
*Herzogiella turfacea* (Lindb.) Iwats. IC IL FC TRTC
*Heterocladium dimorphum* (Brid.) B.S.G. FC 5077
*Homalia trichomanoides* (Hedw.) B.S.G. FC 5242 TRTC
*Homomallium adnatum* (Hedw.) Broth. FC 5449
*Hygroamblystegium fluviatile* (Hedw.) Loeske IC FC
*Hygroamblystegium noterophilum* (Sull. & Lesq. *in* Sull.) Warnst. IC IL
*Hygroamblystegium tenax* (Hedw.) Jenn. IC IL FC
*Hygrohypnum luridum* (Hedw.) Jenn. FC 5511
*Hygrohypnum ochraceum* (Turn. *ex* Wils.) Loeske FC 5650
*Hylocomium splendens* (Hedw.) B.S.G. IC IL FC TRTC
*Hymenostylium recurvirostre* (Hedw.) Dix. IC IL FC
*Hypnum curvifolium* Hedw. TRTC
*Hypnum imponens* Hedw. IL FC
*Hypnum lindbergii* Mitt. IC IL FC TRTC
*Hypnum pallescens* (Hedw.) P. Beauv. IC IL FC
*Hypnum pratense* (Rabenh.) W. Koch *ex* Spruce. IC IL FC TRTC
*Leptobryum pyriforme* (Hedw.) Wils. FC 4882
*Leptodictyum humile* (P. Beauv.) Ochyra IC IL FC
*Leptodictyum riparium* (Hedw.) Warnst. IL FC TRTC
*Leskea polycarpa* Hedw. IC IL FC
*Leskeella nervosa* (Brid.) Loeske IL FC
*Leucobryum glaucum* (Hedw.) Ångstr. *in* Fries IC FC TRTC
*Leucodon brachypus* var. *andrewsianus* Crum & Anderson IC IL FC
*Limprichtia cossonii* (Schimp.) Anderson *et al* = *Drepanocladus revolvens* var. *intermedia* (Lindb.) Grout FC 5826 TRTC
*Limprichtia revolvens* (Sw.) Loeske = *Drepanocladus revolvens* (Sw.) Warnst. IL FC TRTC
*Mnium ambiguum* H. Müll. IL FC
*Mnium marginatum* (With.) Brid. *ex* P. Beauv. IL FC
*Mnium spinulosum* B.S.G. FC 5707
*Mnium stellare* Hedw. IC IL FC TRTC
*Myurella julacea* (Schwaegr.) B.S.G. IC IL TRTC
*Myurella sibirica* (C. Müll.) Reim. FC 5467
*Neckera pennata* Hedw. IC IL FC

*Oncophorus wahlenbergii* Brid. IC IL FC TRTC
*Orthotrichum anomalum* Hedw. IL FC
*Orthotrichum obtusifolium* Brid. IC IL FC
*Orthotrichum pumilum* Sw. FC 5177
*Orthotrichum sordidum* Sull. & Lesq. *in* Aust. FC 5750
*Orthotrichum speciosum* Nees *in* Sturm FC 5525
*Orthotrichum stellatum* Brid. FC 5522
*Oxystegus spiralis* (Grout) Crum & Anderson FC 4767
*Oxystegus tenuirostris* (Hook. & Tayl.) A.J.E. Sm. FC 5232
*Paraleucobryum longifolium* (Hedw.) Loeske IL FC
*Phascum cuspidatum* Hedw. IC IL FC
*Phascum floerkeanum* Web. & Mohr IC IL
*Philonotis fontana* (Hedw.) Brid. IL FC
*Physcomitrium pyriforme* (Hedw.) Hampe IC IL
*Plagiomnium ciliare* (C. Müll.) T. Kop. IC IL FC TRTC
*Plagiomnium cuspidatum* (Hedw.) T. Kop. IC IL FC TRTC
*Plagiomnium drummondii* (Bruch & Schimp.) T. Kop. IC IL TRTC
*Plagiomnium ellipticum* (Brid.) T. Kop. IL FC
*Plagiomnium medium* (B.S.G.) T. Kop. IL FC TRTC
*Plagiopus oederiana* (Sw.) Crum & Anderson FC 5459
*Plagiothecium cavifolium* (Brid.) Iwats. IC IL FC
*Plagiothecium denticulatum* (Hedw.) B.S.G. IC IL FC TRTC
*Plagiothecium laetum* B.S.G. IC IL FC TRTC
*Platydictya confervoides* (Brid.) Crum FC 5694
*Platydictya jungermannioides* (Brid). Crum TRTC
*Platygyrium repens* (Brid.) B.S.G. IC IL FC
*Pleurozium schreberi* (Brid.) Mitt. IC IL FC TRTC
*Pohlia cruda* (Hedw.) Lindb. TRTC
*Pohlia nutans* (Hedw.) Lindb. IC IL FC TRTC
*Pohlia wahlenbergii* (Web. & Mohr) Andrews IL FC
*Polytrichum commune* Hedw. IC IL FC
*Polytrichum formosum* Hedw. FC 5928 TRTC
*Polytrichum juniperinum* Hedw. IC IL FC TRTC
*Polytrichum longisetum* Brid. IL FC
*Polytrichum ohioense* Ren. & Card. IC IL FC
*Polytrichum piliferum* Hedw. IC IL FC
*Polytrichum strictum* Brid. IL FC
*Pottia davalliana* (Sm. *in* Drake) C. Jens. IC IL
*Pottia truncata* (Hedw.) Fürnr. *ex* B.S.G. FC 4780
*Pterigynandrum filiforme* Hedw. IL FC
*Ptilium crista-castrensis* (Hedw.) De Not. IC IL FC
*Pylaisiadelpha tenuirostris* ( Bruch. & Schimp. *ex* Sull.) Buck FC 5929
*Pylaisiella polyantha* (Hedw.) Grout FC 5749 TRTC
*Pylaisiella selwynii* (Kindb.) Crum *et al* IC IL FC
*Racomitrium elongatum* (Ehrh.) Frisv. IL
*Racomitrium ericoides* (Web. *ex* Brid.) Brid. IC IL FC
*Racomitrium heterostichum* (Hedw.) Brid. FC 5782

*Racomitrium lanuginosum* (Hedw.) Brid. IC IL
*Rhizomnium appalachianum* T. Kop. IL FC
*Rhizomnium magnifolium* (Horik.) T. Kop. FC 5673 TRTC
*Rhizomnium pseudopunctatum* (Bruch. & Schimp.) T. Kop. TRTC
*Rhizomnium punctatum* (Hedw.) T. Kop. IC IL FC TRTC
*Rhodobryum ontariense* (Kindb.) Par. *in* Kindb. IC IL FC TRTC
*Rhytidiadelphus triquetrus* (Hedw.) Warnst. IC IL FC TRTC
*Sanionia uncinata* (Hedw.) Loeske IL FC TRTC
*Schistidium apocarpum* (Hedw.) B.S.G. IL FC
*Schistidium rivulare* (Brid.) Podp. IC IL FC
*Scorpidium scorpioides* (Hedw.) Limpr. IL TRTC
*Sphagnum angustifolium* (C. Jens. *ex* Russ.) C. Jens. *in* Tolf. FC 5642
*Sphagnum capillifolium* (Ehrh.) Hedw. IC IL FC TRTC
*Sphagnum centrale* C. Jens *in* Arnell & C. Jens. FC 5164 TRTC
*Sphagnum cuspidatum* Ehrh. *ex* Hoffm. FC 4955
*Sphagnum fallax* (Klinggr.) Klinggr. IL FC
*Sphagnum fimbriatum* Wils. *in* Wils. & Hook *f. in* Hook.*f.* IC IL FC
*Sphagnum fuscum* (Schimp.) Klinggr. IL FC TRTC
*Sphagnum girgensohnii* Russ. FC 5548 TRTC
*Sphagnum magellanicum* Brid. IL FC TRTC
*Sphagnum majus* (Russ.) C. Jens. FC 5762
*Sphagnum papillosum* Lindb. IL
*Sphagnum pulchrum* (Lindb. *ex* Braithw.) Warnst. FC 5763
*Sphagnum recurvum* P. Beauv. FC 5725
*Sphagnum riparium* Ångstr. FC 5817
*Sphagnum rubellum* Wils. IL TRTC
*Sphagnum russowii* Warnst. IL FC
*Sphagnum squarrosum* Crome IC IL FC TRTC
*Sphagnum subsecundum* Nees in Sturm FC 4965
*Sphagnum tenerum* Sull. & Lesq. *in* Sull. *in* Gray FC 5098
*Sphagnum teres* (Shimp.) Ångstr. *in* Hartm. FC 5839
*Sphagnum warnstorfii* Russ. IL FC TRTC
*Sphagnum wulfianum* Girg. FC 5136 TRTC
*Taxiphyllum deplanatum* (Bruch & Schimp.*ex* Sull.) Fleisch. IC IL FC
*Tetraphis pellucida* Hedw. IL FC TRTC
*Thamnobryum alleghaniense* (C. Müll.) Nieuwl. IL FC
*Thuidium delicatulum* (Hedw.) B.S.G. IC IL FC TRTC
*Thuidium philibertii* Limpr. IL FC
*Thuidium recognitum* (Hedw.) Lindb. IC IL FC
*Timmia magapolitana* Hedw. IL FC TRTC
*Tomenthypnum nitens* (Hedw.) Loeske IC IL TRTC
*Tortella fragilis* (Hook. & Wils. in Drumm.) Limpr. IL
*Tortella inclinata* ( Hedw. *f.*) Limpr. FC 5393
*Tortella tortuosa* (Hedw.) Limpr. FC 4683
*Tortula cainii* Crum & Anderson IC IL
*Tortula mucronifolia* Schwaegr. IC FC
*Tortula ruralis* (Hedw.) Gaertn. *et al* IC IL FC
*Trematodon ambiguus* (Hedw.) Hornsch. IC IL

*Ulota crispa* (Hedw.) Brid. IC IL FC
*Ulota hutchinsiae* (Sm.) Hammar IC IL FC
*Warnstorfia exannulata* (B.S.G.) Loeske IC IL FC
*Warnstorfia fluitans* ( Hedw.) Loeske FC 5298
*Weissia controversa* Hedw. IL

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# Mosses from Cameron County, Pennsylvania

**Bruce Allen[1] & Ronald A. Pursell[2]**

Cameron County is located in the north-central region of Pennsylvania near the Allegheny Front on the Allegheny Plateau. Consisting of only 401 square miles, Cameron ranks12th in size among the 67 counties of the Commonwealth. The only town of any appreciable size is Emporium, the county seat. Only Forest and Sullivan, two other northern Pennsylvania counties, have smaller populations. Although small in size, the natural beauty of Cameron is spectacular. The county's major river, the Sinnemahoning, (a tributary of the West Branch of the Susquehanna River) and numerous small Runs have cut sharply down through the Allegheny Plateau. As a result the vertical relief in the county is breathtakingly vivid. Most of Cameron County is forested and more than half of it lies in State Forests or State Game Lands where diverse habitats for bryophytes are found.

Historically, the Sinnemahoning Portage Creek in the northern part of the county has served as a portage between the Allegheny/Ohio/Mississippi and the Susquehanna drainage systems. Today, however, the county lies outside the main transportation routes. Consequently, little bryological work has occurred within its boundaries. Most of the historical collections of Cameron County mosses were reported by Porter (1904), Jennings (1951), Moul (1952), Pursell (1973, 1975), and Manuel (1975). The following list of Cameron County mosses is based on collections made by the authors in 1993 and 1994 as well as mosses found in the herbarium of the Missouri Botanical Garden. All specimens are at MO unless otherwise noted.

AMBLYSTEGIACEAE
*Amblystegium serpens* (Hedw.) Schimp. *ex* B.S.G. *Manuel 2038*
*A. varium* (Hedw.) Lindb. *Allen 14935, 16010, Pursell 9828,11187, 11192*
*Calliergon cordifolium* (Hedw.) Kindb. *Manuel 2043, Pursell 10066*
*Campylium hispidulum* (Brid.) Mitt. *Allen 14935C*
*Hygroamblystegium fluviatile* (Hedw.) Loeske *Eastwood s.n.*
*H. tenax* (Hedw.) Jenn. *Allen 16038, 16091, 16103, 16125*
*Hygrohypnum eugyrium* (Schimp. *in* B.S.G.) Loeske *Pursell 11051, 11247, 11256*
*H. luridum* (Hedw.) Jenn. *Pursell 11247*
*H. molle* (Hedw.) Loeske *Allen 14921, 14922, 16114*

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*H. ochraceum* (Turn. *ex* Wils.) Loeske *Allen 14910, 14916, 14920, 14939, 14955, 16089, 16097, Pursell 11066, 11070, 11232*
*Platylomella lescurii* (Sull. *in* Gray) Andrews *Allen 16104, Pursell 11260*
ANOMODONTACEAE
*Anomodon attenuatus* (Hedw.) Hub. *Allen 14931, 16122a, Pursell 9839, 9840, 11241*
*A. rostratus* (Hedw.) Schimp. *Eastwood s.n.*
*A. rugellii* (C. Müll.) Keissl. *Allen 16029*
AULACOMNIACEAE
*Aulacomnium heterostichum* (Hedw.) Bruch & Schimp. *Eastwood s.n., Pursell 9859*
*A. palustre* (Hedw.) Schwaegr. *Eastwood s.n.*
BARTRAMIACEAE
*Bartramia pomiformis* Hedw. *Allen 16107, 16116, Eastwood s.n.*
*Philonotis fontana* (Hedw.) Brid. *Pursell 11071, 11207*
BRACHYTHECIACEAE
*Brachythecium campestre* (C. Müll.) Schimp. *in* B.S.G. *Allen 14902*
*B. laetum* (Brid.) Schimp. *in* B.S.G. *Allen 14923, 14929, 16121, Pursell 11239, 11261*
*B. plumosum* (Hedw.) Schimp. *in* B.S.G. *Allen 14892, 16006, 16020a, 16033, 16086, 16100*
*B. rivulare* Schimp. *in* B.S.G. *Allen 16034, 16119*
*B. rutabulum* (Hedw.) Schimp. *in* B.S.G. *Allen 14908, 14909, 14911, 14935B*
*B. salebrosum* (Web. & Mohr) Schimp. *in* B.S.G. *Allen 14903*
*Bryhnia graminicolor* (Brid.) Grout *Allen 14938, 16102, 16120*
*B. novae-angliae* (Sull. & Lesq.) Grout *Allen 14894, 14930, 14936, 14954, 16005*
*Eurhynchium hians* (Hedw.) Sande Lacoste *Allen 14899, 14932*
*E. pulchellum* (Hedw.) Jenn. *Allen 16099, Pursell 9851, 11243*
*Platyhypnidium riparioides* (Hedw.) Dix. *Allen 14901, 14919, 16039, 16112, Eastwood s.n.* (3 collections), *Pursell 11197, 11243*
*Steerecleus serrulatus* (Hedw.) Robins. *Allen 16011, Eastwood s.n.* (2 collections), *Pursell 9847*
BRYACEAE
*Bryum capillare* Hedw. *Allen 14944, 16023, 16031, Pursell 11245, 11249*
*B. lisae* De Not. var. *cuspidatum* (Bruch & Schimp. *in* B.S.G.) Marg. *Pursell 11193*
*B. pseudotriquetrum* (Hedw.) Gartn. *et al. Allen 14958, 14959*
*Pohlia annotina* (Hedw.) Lindb. *Allen 16040*
*P. lescuriana* (Sull.) Grout *Allen 16018A*
*P. nutans* (Hedw.) Lindb. *Pursell 9820, 11057*
*Rhodobryum ontariense* (Hedw.) Limpr. *Eastwood s.n., Pursell 9844*
BUXBAUMIACEAE
*Buxbaumia aphylla* Hedw. (*Burnett*, Porter 1904)
*Diphyscium foliosum* (Hedw.) Mohr *Allen 15999*
CLIMACIACEAE
*Climacium americanum* Brid. *Eastwood s.n.*
DICRANACEAE
*Dicranella heteromalla* (Hedw.) Schimp. *Allen 14951, Pursell 11185*
*Dicranum scoparium* Hedw. *Eastwood s.n., Pursell 11258*
*Orthodicranum flagellare* Hedw. *Eastwood s.n.*
*O. fulvum* Hook. *Allen 16042*

*O. montanum* Hedw. *Allen 14925*
*O. viride* (Sull. & Lesq.) Lindb. *Allen 14946,*. *Pursell 11200*
DITRICHACEAE
*Ditrichum lineare* (Sw.) Lindb. *Pursell 9916*
ENTODONTACEAE
*Entodon cladorrhizans* (Hedw.) C. Müll. *Allen, 16118, Pursell 9834, 11208, 1255*
*E. seductrix* (Hedw.) C. Müll. *Allen 16035, 16117, Pursell 10059*
FISSIDENTACEAE
*Fissidens bryoides* Hedw. var. *pusillus* (Wils.) Pursell *Pursell 11043, 11195, 11231*
*F. dubius* P. Beauv. *Pursell 11046, 11198*
FONTINALACEAE
*Fontinalis antipyretica* Hedw. *Allen 16090*
*F. gigantea* Sull. *Eastwood s.n.*
*F. dalecarlica* B.S.G. *Allen 14924, 14926, 16115, 16122, Eastwood s.n.* (2 collections)
*F. novae-angliae* Sull. *Allen 16087*
GRIMMIACEAE
*Racomitrium aciculare* (Hedw.) Brid. *Allen 14956, Pursell 11199, 11257*
*Schistidium apocarpum* (Hedw.) Bruch & Schimp. *in* B.S.G. *Pursell 11252*
*S. rivulare* (Brid.) Podp. *Allen 14942*
HEDWIGIACEAE
*Hedwigia ciliata* (Hedw.) P.- Beauv. *Allen 14950, Pursell 9919, 11211*
HYLOCOMIACEAE
*Loeskeobryum brevirostre* (Brid.) Fleisch. *Allen 16025*
*Pleurozium schreberi* (Brid.) Mitt. *Allen 16003, Pursell 11259*
*Rhytidiadelphus squarrosus* (Hedw.) Warnst. *Allen 14904, 16021*
HYPNACEAE
*Callicladium haldanianum* (Grev.) Crum *Allen 16000, Pursell 9856, 10053*
*Ctenidium molluscum* (Hedw.) Mitt. *Allen 16036*
*Homomalium adnatum* (Hedw.) Broth. *Pursell 9838*
*Hypnum cupressiforme* Hedw. *Allen 14896*
*H. curvifolium* Hedw. *Allen 14891, 16110, Pursell 9821, 10077, 11233*
*H. fertile* Sendtn. *Allen 16016, 16028, Pursell 1005*
*H. imponens* Hedw. *Allen 14900, 14913, 14928, 16127, Pursell 9830, 11254*
*H. lindbergii* Mitt. *Allen 14940*
*H. pallescens* (Hedw.) P. Beauv. *Allen 14893, 14907, 16013, 16020, Pursell 11188, 11240*
*Platygyrium repens* (Brid.) B.S.G. *Allen 14897, Pursell 10144, 11194*
*Pseudotaxiphyllum distichaceum* (Mitt.) Iwats. *Allen 16027*
*P. elegans* (Brid.) Iwats. *Allen 14905, 16019, Pursell 11213*
*Pylaisiadelpha recurvans* (Michx.) Buck *Allen 14915, 16008, Eastwood s.n., Pursell 9832, 11204*
* *Pylaisiadelpha tenuirostris* (Bruch & Schimp *ex* Sull.) Buck was reported by Jennings (1951), but the specimen (On wet rocks 3 mi w. of Truman. June 22, 1935. *Sidney K. Eastwood s.n.*) is *Pylaisiadelpha recurvans.*
LESKEACEAE
*Haplocladium microphyllum* (Hedw.) Broth. *Allen 16001, 16007, Pursell 11184, 11191*
LEUCOBRYACEAE
*Leucobryum glaucum* (Hedw.) Aongstr. *in* Fries *Pursell 11058*
MNIACEAE

*Mnium hornum* Hedw. *Allen 14917, Pursell 10054, 11047, 11234, 11236, 11238*
*Mnium stellare* Reichard *ex* Hedw. *Allen 14898, Pursell 9853*
*Plagiomnium ciliare* (C. Müll.) Kop. *Allen 14934, 16014, Eastwood s.n. (2 collections) , Pursell 9837, 11055, 11190, 11253*
*P. cuspidatum* (Hedw.) Kop. *Eastwood s.n., Manuel 2028,Pursell 9819, 10057, 10074, 11186, 11244*
*Rhizomnium punctatum* (Hedw.) Kop. *Allen 14933, Eastwood s.n., Manuel 2026, Pursell 10050, 10062, 11048*
*R. puncatatum* var. *elatum* (Schimp.) Kop. *Pursell 11212*
NECKERACEAE
*Thamnobryum alleghaniense* (C. Müll.) Nieuw. *Allen 14952*
ORTHOTRICHACEAE
*Ulota crispa* (Hedw.) Brid. *Allen 14895, 14928, Pursell 11044, 11202*
*U. hutchinsiae* (Sm.) Hammar *Allen 16111*
PLAGIOTHECIACEAE
*Plagiothecium cavifolium* (Brid.) Iwats. *Allen 16037, 16093, 16105, 16113, 16126, Pursell 11205, 11248*
*P. denticulatum* (Hedw.) Schimp. *in* B.S.G. *Allen 14947, Eastwood s.n., Pursell 9829, 10145, 11203*
*P. laetum* Schimp. *in* B.S.G. *Allen 16030, Pursell 10049, 11053, 11061, 11235*
POLYTRICHACEAE
*Atrichum angustatum* (Brid.) Bruch & Schimp. *in* B.S.G. *Allen 16043*
*A. oerstedianum* (C. Müll.) Mitt. *Allen 14937, 14914, Pursell 11189, 11210*
*A. undulatum* (Hedw.) P. Beauv. *Allen 16002*
*Pogonatum pensilvanicum* (Hedw.) P. Beauv. *Allen 16018*
*Polytrichum commune* Hedw. *Allen 16009, Pursell 11209*
*P. juniperinum* Hedw. *Allen 16022*
*P. pallidisetum* Funck *Allen 16041, Pursell 11196*
POTTIACEAE
*Barbula unguiculata* Hedw. *Allen 14960*
*Hyophila involuta* (Hook.) Jaeger *Pursell 9847*
*Tortella humilis* (Hedw.) Jenn. *Allen 16124, Pursell 11262*
*T. tortuosa* (Hedw.) Limpr. *Allen 16026*
SEMATOPHYLLACEAE
*Sematophyllum marylandicum* (C. Müll.) Britt. *Allen 14941*
SPHAGNACEAE
*Sphagnum affine* Ren. & Card. *Allen 16095*
*S. girgensohnii* Russow *Allen 14948*
*S. lescurii* Sull. & Lesq. *Allen 14945*
*S. palustre* L. *Allen 14953*
TETRAPHIDACEAE
*Tetraphis pellucida* Hedw. *Allen 14906, Pursell 11201*

THELIACEAE
*Thelia asprella* Sull. *Eastwood s.n.*
THUIDIACEAE
*Thuidium delicatulum* (Hedw.) Schimp. *in* B.S.G. *Allen 14912, 16088, Eastwood s.n., Pursell 9842*

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# EVANSIA

Volume 18 Number 4

**The genus *Sphagnum* sections *Sphagnum*, *Rigida*, Squarrosa, and *Isocladus*(Musci: Sphagnaceae) in Maine**
Lewis E. Anderson & Bruce Allen **109**

**Additions to the lichen flora of North America X. *Buellia arborea***
Tor Tønsberg and Bruce McCune **128**

**New, rare, and interesting lichen taxa collected on the 2000 ABLS, Field Trip "Oregon Steppe to the Coast"; led by Dr. Bruce McCune. Aug. 10-13, 2000**
List compiled by: Roger Rosentreter **129**

**The Synonymy of the African Moss Genus *Quathlamba* with the American genus *Neosharpiella*.**
Harold Robinson, Bruce Allen and Robert E. Magill **133**

**The genus *Seligeria* (Musci: Seligeriaceae) in Maine**
Bruce Allen **137**

**Colorado Bryological Hot Spots**
William A. Weber & Ronald C. Wittmann **143**

**Correction to "An improved miniprep method of DNA extraction for bryophytes"**
James Bray Jr. & Kelsi Scott **147**

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# The genus *Sphagnum* sections *Sphagnum*, *Rigida*, Squarrosa, and *Isocladus* (Musci: Sphagnaceae) in Maine

**Lewis E. Anderson[1] & Bruce Allen[2]**

*Sphagnum* L., Sp. Pl. 1106. 1753.
*Isocladus* Lindb., Öfvers. Förh. Kongl. Svenska Vetensk..-Akad. 19: 133. 1862.

Plants coarse and robust to slender and delicate, mostly growing in wet habitats, particularly in bogs and fens, sometimes on moist to wet soils and rocks, forming blankets, mounds, cushions, hummocks, and often submerged with capitulum emergent in pools and lake margins. Stem and branch leaves nearly always differentiated, but hemi-isophylly common in most species in which stem leaves resemble branch leaves in varying degrees of shape and structure. Cortical cells of stem, rarely undifferentiated, usually consisting of 1-several layers of large, hyaline, empty, thin-walled cells, sometimes fibrillose and porose surrounding a wood cylinder consisting of thin-walled prosenchymatous cells becoming thicker walled toward the outside; stem leaves usually more distantly arranged than branch leaves, generally lingulate, extensively resorbed on the outer surface, finely fringed at the margins. Branches usually in spirally arranged fascicles of two or more divergent or spreading branches and two or more pendent or hanging branches, usually becoming crowded at the stem apex into a noticeable capitulum. Stem and branch leaves ecostate, unistratose, consisting of a network of narrow, elongated green cells completely surrounded by large, rhomboidal, empty, hyaline cells, stem leaf hyaline cell walls typically without pores and fibrils; branch leaf hyaline cell walls with at least some pores, often many, and with one exception, round or elliptic, ring-shaped or spiral fibril bands. Dioicous or monoicous. Perichaetial leaves much larger than stem or branch leaves; leaves of antheridial branches generally colored, scarcely differentiated, antheridia globose, on long stalks, produced singly in leaf axils. Capsules globose, operculate, without annulus or peristome, borne on an elongated gametophytic pseudopodium, attached by a large foot, sessile to generally elevated above the perichaetial leaves, becoming brown to black when mature; exothecial cells usually with scattered pseudostomata, consisting of paired guard cells but lacking an opening, more numerous toward the base, columella dome-shaped, overarched by the spore sac; spores triradiate with conspicuous ridges, smooth to roughened, explosively ejected a short distance, leaving the capsule cylindrical or, with age, somewhat urceolate. Chromosome number n = 19 or 38, + 0-variable numbers of m-chromosomes.

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Crum's (1984) richly illustrated Flora of North American *Sphagnum* is an excellent reference work and is most helpful in identifying species. The present treatment draws heavily from this and other works, especially Andrews (1913), Crum & Anderson (1981), Andrus (1980), and Daniels & Eddy (1985).

*Sphagnum* is taxonomically a difficult group. Part of the difficulty in naming *Sphagnum* collections is technical: in order to work through many keys the plants must be extensively dissected, stems and branches examined in cross section as well as in surface view, and cross-sections made of stem and branch leaves. Many of *Sphagnum's* technical features, especially the pores, are more easily seen when the leaves and stems are lightly stained. When working with *Sphagnum* the importance of making good leaf cross sections, which should be made in the upper ½–⅔ of the leaf, cannot be overemphasized.

**Key to *Sphagnum* sections**

1. Branch leaves without fibril bands .................... 4. *Sphagnum* section *Isocladus*
1. Branch leaves with fibril bands .................................................................... 2
    2. Fascicles containing 6–8 branches ......... *Sphagnum* section *Polyclada*
    2. Fascicles containing less than 6 branches ........................................ 3
3. Branch leaves with a resorption furrow along the margins (best viewed in cross section) ........................................................................................ 4
3. Branch leaves without a resorption furrow .................................................. 6
    4. Branch leaves strongly cucullate, roughened on back near the apex; stem and branch cortex fibrillose, sometimes faintly so ............................................... 1. *Sphagnum* section *Sphagnum*
    4. Branch leaves not or only slightly cucullate, not roughened on back near the apex; stem and branch cortex efibrillose .................... 5
5. Branch leaf green cells in cross section more broadly exposed on the inner surface ............................................... *S. molle* [section *Acutifolia*]
5. Branch leaf green cells in cross section enclosed or more broadly exposed on the outer surface ........................................ 2. *Sphagnum* section *Rigida*
    6. Plants without a distinct capitulum; branches in irregular fascicles of 1–3, loosely arranged around the stem ..................................... 7
    6. Plants with a distinct, bushy capitulum; branches in regular fascicles of 3–5, spirally arranged around the stem ................................ 8
7. Branch leaf hyaline cells with pores usually restricted to the ends and corners, not in bead-like rows along the commissures ................................ ........................................................... *Sphagnum* section *Hemitheca*
7. Branch leaf hyaline cells with numerous small pores arranged in bead-like rows or scattered along the commissures .................................... ................................................ *Sphagnum* section *Subsecunda* (in part)

8. Branch leaf green cells rectangular or slightly trapezoidal in cross section, exposed about equally on both surfaces .............................................. *Sphagnum* section *Subsecunda* (in part)
8. Branch leaf green cells triangular to trapezoidal, exposed more on either the inner or outer surface ............................................. 9
9. Branch leaf green cells exposed more on the inner surface .................................................................................. *Sphagnum* section *Acutifolia*
9. Branch leaf green cells exposed more on the outer surface ........................... 10
10. Stem terminal bud prominent. Branch leaves at middle with hyaline cell pores numerous, greater than 15 µm in diameter; walls of the hyaline cells adjacent to the green cells faintly papillose ... ................................................ 3. *Sphagnum* section *Squarrosa*
10. Stem terminal bud not conspicuous. Branch leaves at middle with hyaline cell pores various, less than 12 µm in diameter; walls of the hyaline cells adjacent to the green cells smooth ............................................................. *Sphagnum* section *Cuspidata*

1. *Sphagnum* section *Sphagnum* L., Sp. Pl. 1106. 1753.

Plants normally fairly large, capitula distinct with turgid, pointed or blunt branches, found in wet places in cushions, hummocks, mats, carpets, and rocky shelves, both in open and shaded areas. Stems generally stout, greenish to black, cortical cells large, square, rectangular, or multi-sided, generally in 3–4 layers, outer walls of the outer layer usually fibrillose with pale, delicate to strong, closely arranged fibrils, with 1–10, rarely more, fairly large, generally circular pores; inner cortical cells usually with widely spaced, thin fibrils, the innermost walls adjacent to the wood cylinder sometimes with strong, closely spaced, striate fibrils. Stem leaves large, lingulate to ligulate, flat to slightly concave, with a fringed border due to partial resorption of cells at the margin, both outer and inner walls of hyaline cells partially or almost completely resorbed. Branches stout, often tumid, pointed, with closely overlapping leaves when dry; cortical cells fibrillose, branch leaves broadly ovate, deeply concave, and cucullate, rough on back near apex because of extreme resorption of the hyaline cells; hyaline cell pores on the outer surface elliptic or round, few or numerous, often in 3's where the cells meet, pores on the inner surface fewer and generally smaller; hyaline cell walls adjacent to the green cells smooth, papillose, or roughened with lines of comb fibrils or alveolate ridges; in cross section green cells entirely included with no exposure on either surface, exposed equally on both surfaces, or exposed more broadly on the inner surface. Dioicous. Capsules black when mature, spores smooth to roughened or finely papillose.

The species grouped into section *Sphagnum* can generally be recognized in the field as belonging to that section by their relatively robust aspect with turgid branches and closely overlapping leaves. Plants of some species of section *Subsecundum* have a somewhat similar aspect, but generally can be told by their bluish tinge. Plants of section *Sphagnum* can easily be distinguished microscopically by the presence of fibril bands on the stem and branch cortex, the usually broader exposure in cross section of the branch leaf green cells, and by their broadly ovate branch leaves with cucullate-concave apices that are roughened on the back due to excessive resorption.

1. Branch leaf green cells in cross section usually broadly elliptic to almost round with end walls on both surfaces unthickened and entirely included; hyaline cells with almost no free convexity. Plants often pinkish to red, especially in sunny habitats .............. 1. *S. magellanicum*

1. Branch leaf green cells in cross section narrowly elliptic to rectangular with both end walls thickened and exposed, or variously triangular to trapezoidal and exposed on one or both surfaces; hyaline cells with considerable free convexity on one or both surfaces. Plants rarely tinged red .......... 2

    2. Branch leaves in cross section with green cells more or less rectangular, end walls equally thickened and exposed, lumens narrowly elliptic to lenticular .............................. 2. *S. centrale*

    2. Branch leaves in cross section with green cells more or less triangular, sometimes narrowly trapezoidal, end walls exposed slightly more broadly on the inner surface, lumens more or less triangular, sometimes narrowly trapezoidal ............................ 3

3. Branch leaves in cross section with green cells equilateral-triangular ............. 4

3. Branch leaves in cross section with green cells isosceles-triangular ................ 5

    4. Inner stem cortical cell walls next to the wood cylinder with distinct fibrils; stem leaf hyaline cells without comb fibrils; branch leaf hyaline cells usually with comb fibrils, but sometimes smooth; plants green, pale to yellowish green ........................ 5. *S. affine*

    4. Inner stem cortical cell walls next to the wood cylinder without distinct fibrils; stem and branch leaf hyaline cells with comb fibrils; plants reddish to yellowish brown .............. 6. *S. austinii*

5. Stem leaf hyaline cells mostly divided; branch leaf hyaline cell walls adjacent to the green cells finely papillose, rarely smooth or nearly so ................ ........................................................ 4. *S. papillosum*

5. Stem leaf hyaline cells not divided; branch leaf hyaline cell walls adjacent to the green cells smooth ...................................................... 3. *S. palustre*

1. *Sphagnum magellanicum* Brid., Muscol. Recent. 2(1): 24. 1798.
*Sphagnum medium* Limpr., Bot. Centralbl. 7: 313. 1881.

Plants more or less robust, in small cushions to large hummocks, bright green, variously tinged pink, solid pink, or deep red, capitulum somewhat rounded, young branches bunched. Stem cortical cells in 3–4 layers, fibrillose (often faintly so), pores 1–2 in each cell; wood cylinder reddish to brown; stem leaves large, lingulate to long-lingulate to somewhat ligulate or spatulate; hyaline cells not divided. Branches generally in fascicles of 4–5 with 2–3 spreading branches; cortical cells mostly uniporose, weakly fibrillose; branch leaves broadly ovate, deeply concave and cucullate, strongly roughened on back at the apex (best seen in profile); hyaline cells on the outer surface with numerous elliptical pores in the cell corners and along the commissures, 4–10 per cell, on inner surface with few or no pores (rarely more than 5), mainly confined to the corners and along commissures; in cross section green cells elliptic, fully included, more or less centrally placed, end walls not thickened; hyaline cell side walls adjacent to the green cells smooth. Dioicous. Antheridial branches poorly differentiated, sometimes slightly pigmented reddish or brownish. Perichaetial leaves large, ovate, hyaline cells fibrillose and porose above, toward the base uniformly narrow, elongate and pitted. Pseudostomata numerous, scattered throughout the capsule. Spores minutely papillose, more or less 25 µm.

Illustrations. Crum & Anderson (1981), Fig. 1 A–G; Crum (1984), Fig. 1.

In small cushions to large hummocks in a variety of sun and shade habitats, poor to rich peatlands, Alder, Spruce, *Chamaedaphne*, Red Maple, Hemlock and *Thuja* swamps. In Maine known from Androscoggin (*Allen 22475* DUKE, MO), Aroostook (*Worthley 1539* DUKE, MO), Cumberland (*Allen 15936* DUKE, MO), Franklin (*Correll & Correll 11137* DUKE), Hancock (*Pedano 410* DUKE, MO), Kennebec (*Andrus 7192* DUKE), Lincoln (Allen & Pursell *Maine Mosses 5* DUKE, MAINE, MO, NY, US), Oxford (*Reed 8/25/35* DUKE), Penobscot (*Harvey 8* NY), Piscataquis (*Hermann 19152* DUKE, NY), Sagadahoc (*Allen 15753* DUKE, MO), Somerset (*Ladd 8884* MO), Waldo (*Norton 4* DUKE), Washington (*McCleary 16614* DUKE, MO), and York (*Allen 22036* DUKE, MO) Counties.

*Sphagnum magellanicum* is common and essentially world wide in distribution. It can usually be distinguished in the field by its characteristic pinkish to reddish color. It is the only member of section *Sphagnum* with this coloration, although in shade and sometimes even in full sun, for unknown reasons, it occasionally fails to develop a red color. Microscopically, it can be identified by examining branch leaf cross sections which reveal entirely included, typically elliptical green cells that are not thickened at the ends. Unfortunately, *S. magellanicum* can sometimes have lenticular-shaped green cells in section and these collections can be difficult to distinguish from *S. centrale*. In general, the hyaline cells of *S. magellanicum* in cross section have very little convexity on either surface, while those of *S. centrale* have more convexity on the outer than on the inner surface.

*Sphagnum compactum* (section *Rigida*) is similar to *S. magellanicum* in having entirely included green cells and denticulate branch leaf margins due to the presence of resorption furrows. It differs from *S. magellanicum* in having stem cortical cells that lack fibrils and pores. Furthermore, although the branch leaves of *S. compactum* can rarely be slightly cucullate they are not as strongly cucullate as the branch leaves of *S. magellanicum* and never roughened on the back. In addition, in *S. magellanicum* the stem leaves are as long or longer than the branch leaves while in *S. compactum* the stem leaves are much shorter than the branch leaves. At times the fibrils on the branch cortical cells of *S. magellanicum* can be faint or almost lacking, and so other characters must be relied upon to identify the species.

2. *Sphagnum centrale* C. Jens., Bih. Kongl. Svenksa. Vetensk.-Akad. Handl. 21, 3(10): 34. 1896.
    *Sphagnum palustre* ssp. *intermedium* Russ., Schriften Naturf.-Ges. Univ. Dorpat 3: 28. 1887.
    *Sphagnum papillosum* (Russ.) Warnst. var. *intermedium* (Russ.) Warnst., Hedwigia 30: 160. 1891.
    *Sphagnum palustre* var. *centrale* (C. Jens.) Eddy *in* Daniels & Eddy, Handb. Eur. Sphagna 50. 1985.

Plants robust, generally in compact mats, light-green to yellowish. Stem cortical cells in 3–4 layers, weakly fibrillose, pores 1–4 in each cell; wood cylinder greenish to brownish; stem leaves lingulate, rounded at the apex; hyaline cells not divided, usually not fibrillose, generally somewhat resorbed on both surfaces. Branches in fascicles of 4–5 with 2 spreading branches; cortical cells weakly fibrillose; branch leaves broadly ovate, concave-cucullate, roughened on the back at the apex; hyaline cells on the outer surface with up to 6 elliptic, ringed pores in 2's or 3's at ends and corners, and along commissures, on the inner surface at times with 3 smaller, mildly elliptical to round pores at the cell junctions and 1–3 along the commissures; in cross section, green cells elliptic to nearly lenticular, about equally exposed on both surfaces, end walls thickened, sometimes narrowly so. Dioicous. Antheridial branches little differentiated. Pseudostomata mostly confined to the base of the capsules. Spores nearly smooth to minutely roughened, more or less 25 µm.

Illustrations. Crum & Anderson (1981), Fig. 1 H–N; Crum (1984), Fig. 2.

In mats, shaded depressions in *Thuja* and other somewhat calcareous swamps, often temporarily submerged. In Maine known from Androscoggin (Allen & Pursell *Maine Mosses 102* DUKE, MAINE, MO, NY, US), Aroostook (*Worthley me-170* DUKE, MO), Cumberland (*Lowe 3182* MO), Franklin (Allen & Pursell *Maine Mosses 103* DUKE, MAINE, MO, NY, US), Hancock (*Bowers 10083* DUKE, MO), Oxford (*Dunham 19* DUKE), Piscataquis (*Crane 598* DUKE), Somerset (*Allen 21467A* DUKE, MO), and Washington (*Worthley me-227* DUKE, MO) Counties.

*Sphagnum centrale* is often confused with unusual forms of *S. papillosum.* Normally, *S. papillosum* differs from *S. centrale* in having the branch leaf hyaline cell walls adjacent to the green cells finely, densely papillose, and narrowly triangular green cells that are exposed only on the inner surface. In *S. centrale* the branch leaf hyaline cell walls are smooth and the elliptic to nearly lenticular green cells have thickened end walls that are equally exposed on both surfaces.

There are, however, forms of *S. papillosum* that have smooth branch leaf hyaline cell walls adjacent to somewhat trapezoidal green cells. These contrary forms, known as *S. papillosum* var. *laeve* Warnst., can be troublesome to identify. In distinguishing the two species it is helpful to note that the stem leaf hyaline cells of *S. papillosum* are 1-divided, except toward the base, while those of S. centrale are not divided.

Daniels & Eddy, (1985) found a resemblance between *S. centrale* and *S. palustre* in Europe and the British Isles, and as a result treated *S. centrale* as a variety of *S. palustre.* North American material of *S. centrale,* however, does not indicate such a close resemblance. The principal differences between these two are found in the shape and exposure of the branch leaf green cells. In North American plants of *S. centrale* the green cells in cross-section are rather narrowly elliptic or lenticular and exposed on both surfaces owing to a thickening of the cell ends. In Maine plants of *S. palustre* the green cells in cross-section are mostly narrowly isosceles-triangular (rarely trapezoidal) and exposed only on the inner surface.

3. *Sphagnum palustre* L., Sp. Pl. 1106. 1753.
   *Sphagnum palustre* L. var. *cymbifolium* Ehrh., Hannover. Mag. 15: 235. 1780.
   *Sphagnum cymbifolium* (Ehrh.) Hedw., Fund. Hist. Nat. Musc. Frond. 2: 86. 1782.
   *Sphagnum vulgare* Michx., Fl. Bor.-Amer. 2: 285. 1803.

Plants low to robust, sometimes in extensive, shallow to deep, cushions, light yellowish green or brownish. Stem cortical cells in 3–4 layers, fibrillose, pores 2–7 in each cell; wood cylinder brown; stem leaves large, elongate-lingulate or sometimes spatulate; hyaline cells not divided, occasionally fibrillose, generally resorbed and with one or more membrane gaps on the outer surface. Branches stout, in fascicles of 4–5, with 2 spreading branches; cortical cells often uniporose, fibrillose; branch leaves imbricate to spreading or squarrose, broadly ovate, concave-cucullate, roughened on the back at the apex; hyaline cells on the outer surface with large, rounded to elliptic, end and corner pores, often in groups of 2 or 3, pores more numerous toward the base, sometimes with individual pores enclosed in loop-like or sigmoid fibrils (*i.e*, ringed), sometimes with numerous elliptic or round commissural pores, one between each fibril, on the inner surface with fewer, round pores, mostly confined to the cell center; in cross section green cells isosceles-triangular, exposed only on the inner surface, rarely somewhat broadly trapezoidal with broader exposure on the inner surface; hyaline cell side walls adjacent to the green cells smooth or variously marked with a network of very faint to conspicuous ridges. Dioicous. Antheridial branches poorly differentiated, perigonial leaves sometimes slightly brownish. Perichaetial leaves elongate-ovate, hyaline cells fibrillose and porose above, toward the base cells uniformly narrow. Spores granular, more or less 25 µm.

Illustrations. Crum & Anderson (1981), Fig. 2; Crum (1984), Fig. 4.

In various wet lands, lake and pool margins, wooded swamps, poor fens, bogs, seepage cliffs, and cattail marshes in both open and shaded habitats. In Maine known from Androscoggin (*Allen 14704* DUKE, MO), Cumberland (Allen & Pursell *Maine Mosses 6* DUKE, MAINE, MO, NY, US), Hancock (*Magill 11804* DUKE, MO), Kennebec (*Gordon 16* DUKE), Lincoln (*Allen 1301* MO, NY), Oxford (*Norton 3* DUKE), Penobscot (*sin. nom. 8/20/57* DUKE), Piscataquis (*Hermann 19155* DUKE), Sagadahoc (*Allen 14593* DUKE, MO), Washington (*Pursell 12146* DUKE, MO, NY), and York (*Redfearn 33842* DUKE, MO) Counties.

*Sphagnum palustre* and *S. papillosum* are very similar in aspect, and in fact they are impossible to separate in the field. Furthermore, the branch leaves in cross section of both species have isosceles-triangular green cells that are usually exposed only on the inner surface. Normally, *S. papillosum* is distinguished from *S. palustre* by its branch leaf hyaline cells that are papillose on the side walls adjacent to the green cells. In contrast the branch leaf hyaline cells of *S. palustre* are smooth. There is an expression of *S. papillosum* (as noted above sometimes called *S. papillosum* var. *laeve*) with branch leaf hyaline cells that are smooth on the side walls adjacent to the green cells. This difficult expression of *S. papillosum* can be distinguished from *S. palustre* by examining the hyaline cells of the stem leaves; in *S. palustre* these cells are undivided, while at least some of those in *S. papillosum* are 1–2 divided. We have not seen any Maine specimens of *S. henryense*, a doubtful species which closely resembles *S. palustre*. It differs from *S. palustre* only by sometimes having a network of very faint to conspicuous ridges on the side walls adjacent to the green cells.

4. *Sphagnum papillosum* Lindb., Acta Soc. Sci. Fenn. 10: 280. 1872.
*S. papillosum* var. *sublaeve* Warnst., *in* Röll, Flora 69: 471. 1886.
*S. papillosum* var. *laeve* Warnst., Sitzungsber. Naturf.-Ges. Univ. Jurjeff 10: 429. 1895.

Plants robust, usually in loose, sometimes extensive carpets, pale-green to brownish. Stem cortical cells in 3–4 layers, square, rectangular or multi-sided, fibrillose, fibrils thin and often faint, pores large, 1–2 (–5) in each cell, walls of innermost cortical cells adjacent to the wood cylinder fibrillose; wood cylinder greenish to brownish or black; stem leaves short- to long-lingulate; at least some hyaline cells divided, without fibrils or pores (unless hemi-isophyllous), most walls of both surfaces resorbed. Branches short and plump, in fascicles of 2–5 with 2 spreading branches; cortical cells often with a single pore at the upper end, fibrillose; branch leaves imbricate to spreading, broadly ovate, strongly concave, cucullate; hyaline cells on outer surface with 4–10 rounded or elliptic pores at ends and corners and along commissures, often 3 in adjoining corners, on the inner surface with variable numbers of smaller round pores toward the middle; in cross section green cells narrowly isosceles-triangular, sometimes with somewhat curved sides and rarely slightly trapezoidal with narrower exposure on the outer surface; hyaline cell side walls adjacent to the green cells usually finely papillose (sometimes lacking or scarce and faint). Dioicous. Antheridial branches not obvious, perichaetial leaves elongated, concave. Capsules with numerous scattered pseudostomata. Spores papillose, more or less 30 μm.

Illustrations. Crum & Anderson (1981), Fig. 3 A–J; Crum (1984), Fig. 6.

Occurring as thick carpets and large hummocks in minerotrophic and graminoid bogs, fens, and other exposed wet areas, including over rocks at higher elevations. In Maine known from Hancock (*Pedano 650* DUKE, MO), Kennebec (*Andrus 7188* DUKE), Oxford (*Correll & Correll 11155* DUKE), Piscataquis (*Merrill 2 NY*), Penobscot (*Lowe 8/20/57* DUKE), Sagadahoc (*Norton 19* DUKE), Waldo (*Norton 21* DUKE), and Washington (*Crum 9/91* MICH, MO) Counties.

*Sphagnum papillosum* is ordinarily easily recognized by its branch leaves that have hyaline cells with papillose side walls adjacent to the green cells. No other member of section *Sphagnum* in Maine has this feature. As noted above, however, there are some populations of *S. papillosum* that have branch leaves with smooth hyaline cell side walls, and these can be mistaken for *S. centrale* or

*S. palustre*. These two species, however, generally have undivided stem leaf hyaline cells, while at least some of the stem leaf hyaline cells in *S. papillosum* are divided. In the field *S. papillosum* can sometimes be recognized by its short, stout, blunt branches, and a characteristic golden to dark brownish color. Unfortunately, this coloration is not a consistent feature of the species and there are many collections, especially those from shaded situations, with green plants.

5. *Sphagnum affine* Ren. & Card., Rev. Bryol. 12: 44. 1885.
*Sphagnum imbricatum* var. *affine* (Ren. & Card.) Warnst., Hedwigia 28: 370. 1889.
*Sphagnum imbricatum* ssp. *affine* (Ren. & Card.) Flatb., Kongel. Norske Vidensk. Selsk. Skr. (Trondheim) 1984(3): 180. 1984.
*Sphagnum imbricatum* var. *flagellare* (Röll) Card., Répert. Sphagnol. 80. 1884.

Plants moderately robust, in mats, cushions, hummocks, or carpets, pale to dark-green, yellowish to dark-brown. Stem cortical cells in 3–4 layers, square to rectangular, delicately fibrillose, pores large, 1–11 in each cell, sometimes coalesced, walls of innermost cortical cells adjacent to the wood cylinder with well-defined, cross-striate comb fibrils; wood cylinder generally black; stem leaves (often on the same plant) variable in length, lingulate, rarely slightly ligulate, with a broad, rounded apex, much resorbed, hyaline cells 1–2 divided, lacking comb fibrils. Branches usually in fascicles of 5, with 2 spreading branches; cortical cells with (0)–1–(2) pores, fibrillose; branch leaves usually somewhat spreading to sub-squarrose, ovate-cucullate, roughened on the back; hyaline cells on the outer surface with few to numerous, elliptic pores in 3's at adjacent corners and along the commissures, on the inner surface with a variable number of round pores in the cell center; in cross section green cells equilateral-triangular, occasionally slightly trapezoidal, hyaline cell side walls adjacent to the green cells with or without comb fibrils, when present often restricted to extreme basal cells, variable in prominence and extension toward the apex. Dioicous. Antheridial branches poorly differentiated, perigonial leaves sometimes slightly pigmented brown. Perichaetial leaves large, ovate, hyaline cells fibrillose and porose above, toward the base uniformly narrow. Spores almost smooth, more or less 25 μm.

Illustrations. Crum & Anderson (1981), Fig. 4 ( as *S. imbricatum*); Crum (1984), Fig. 7 (as *S. imbricatum*).

Found in a variety of wetlands, both open and shaded, from wooded swamps and wet forests to open, shrubby or grass-sedge bogs, meadows, roadside ditches, moist ledges and edges of vegetation mats on exposed rocks. In Maine known from Androscoggin (*Allen 22392* DUKE, MO), Aroostook (*Worthley me-200*

DUKE, MO), Cumberland (*Allen 15911* DUKE, MO), Hancock (Rand 7/3/1891, DUKE), Knox (*Norton 4* DUKE), Oxford (*Parlin 9/1939* DUKE), Sagadahoc (*Andrus 7157* DUKE), Waldo (*Soloman 20188* DUKE, MO), and York (*Allen 21317* DUKE, MO) Counties.

*Sphagnum affine* until recently has generally been included within the variability of *S. imbricatum sensu lato*. In this broad sense *S. imbricatum* is a widespread species that occurs throughout most of North America, Asia, and Europe (Crum 1984, 1997). *Sphagnum imbricatum* has over time been broken into several segregates (see Flatberg, 1984; Andrus, 1984, 1987) and treated respectively as subspecies, varieties, or distinct species. Two of these segregates, *S. affine* and *S. austinii*, occur in Maine. Although Crum (1984, 1997) found no reason to recognize any of the segregates at any level, we recognize two of them at the species level with some reluctance. They can be sorted out rather easily by the presence in the stems of *S. affine* of well-defined, cross-striate comb-fibrils on the inner walls of the innermost layer of cortical cells, i.e., those next to the wood cylinder, and the absence of comb-fibrils on the stem leaf hyaline cell side walls. In *S. austinii* the inner walls of the innermost layer of stem cortical cells lack comb-fibrils, but the stem leaf hyaline cell side walls have well-developed comb-fibrils. Unfortunately, the outer walls of the stem cortical cells in both taxa are generally finely, delicately fibrillose, and extreme care must be exercised in removing the cortex and making sure that the inner and outer walls are distinguished. Andrus (1984, 1987) suggested that the branch cortical cells of *S. austinii* are connected by funnel-shaped end walls; we have not been able to confirm this observation in our material. According to Flatberg (1984) *S. imbricatum sensu stricto* is not known from North America and seems to be restricted to Asia. Specimens from our area named *S. imbricatum* are either *Sphagnum affine* (*sensu* Flatberg) or less likely *S. austinii*. *Sphagnum austinii* is rare in Maine, but abundant on the Pacific Coast of North America, south of Alaska.

6. *Sphagnum austinii* Sull. *in* Aust., Musci Appalach. [3]. 1870.
    *Sphagnum imbricatum* ssp. *austinii* (Sull.) Flatberg. Kongel. Norske Vidensk. Selsk. Skr. (Trondheim) 1984(3): 46. 1984.
    *Sphagnum carlottae* Andrus *in* Andrus & Vitt, Sphagnoth. Bor.-Amer. No. 189. 1982.

Plants fairly robust, in compact hummocks, reddish to yellowish brown. Stem cortical cells in 3–4 layers, square to rectangular, delicately fibrillose, pores 4–8 in each cell, walls of the innermost cortical cells adjacent to the wood cylinder without comb fibrils, at most with a few thin, widely separated fibrils; wood cylinder brown to blackish; stem leaves ligulate, almost straight-sided, to somewhat lingulate and broadly rounded at the apex, moderately bordered with fringed resorbed cells, especially at the rounded apex, hyaline cell side walls adjacent to the green cells with comb fibrils, many of which are resorbed, leaving short stubs along the walls, hyaline cells infrequently 1-septate, usually non-septate. Branches in fascicles of 3, with 2 spreading and 1 pendent branches, fascicles generally crowded, branches tightly imbricate and pointed; cortical cells with 0–2 pores, fibrillose; branch leaves large, usually broadly ovate with cucullate apex, roughened on the back at the apex; hyaline cells on the outer surface with few to numerous, elliptic pores in 3's at adjacent corners and along the commissures, on the inner surface with a variable number of round pores in the cell center; in cross section green cells equilateral-triangular with greatest exposure on the inner surface, hyaline cell side walls adjacent to the green cells with numerous and distinct comb fibrils extending almost to the apex. Sporophytes not seen from North America.

Illustrations. Andrus (1984), Figs. 3–7; Flatberg (1984), Figs. 12C–D, 13D, 18D–E.

In hummock with *Sphagnum fuscum*. In Maine known from Kennebec (*Andrus 7198* DUKE) and Washington (*Spaulding 101* DUKE, MO) Counties.

*Sphagnum austinii* is distinguished from *S. affine* principally by the absence of comb fibrils on the innermost walls of the stem cortical cells adjacent to the wood cylinder and by the presence on the stem leaves of comb fibrils on the hyaline cell side walls adjacent to the green cells. In contrast *S. affine* has well-defined, cross-striate comb fibrils on the innermost walls of the stem cortical cells, but the stem leaf hyaline cells lack comb fibrils. Andrus (1987) gives in table form a helpful comparison of the differences between these two species.

### 2. *Sphagnum* section *Rigida* Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 19: 135. 1862.

Plants in low-growing, compact cushions or loose mats. Stem and branch cortical cells without fibrils; stem cortical cells without pores; branch cortical cells uniporose at upper ends, somewhat retort-like. Stem leaves very small, less than 1 mm long, lingulate to triangular; hyaline cells not divided, without pores or fibrils, unless hemi-isophyllous. Branch leaves often squarrose, longer than stem leaves, 1.5–3.0 mm long, broad, ovate to elliptical, concave, broadly truncate at the apex, not or only slightly cucullate, not roughened at the back of the apex; margins somewhat denticulate because of resorption furrows.

Members of section *Rigida* share several characters with those of section *Sphagnum*, such as branch leaves with both resorption furrows and a tendency for the hyaline cells to have pores grouped in 3's at adjacent cell angles. In section

*Rigida*, however, the branch hyaline cells have pores grouped in 3's on the inner surface while in section *Sphagnum* they are grouped in 3's on the outer surface. The two Maine species of section *Rigida* also differ from those of section *Sphagnum* in having efibrillose stem and branch cortical cells, and branch leaves with apices broadened at back but not strongly cucullate and roughened.

1. Branch leaf green cells more or less elliptic, entirely included but sometimes closer to the outer surface; hyaline cell walls adjacent to the green cells smooth; outer surface of branch leaves with few to many pseudopores; stem leaves lingulate to oblong-triangular, apices rounded, auriculate, bordered at the base .................................................... 7. *S. compactum*
1. Branch leaf green cells isosceles-triangular or trapezoidal, more broadly exposed on the outer surface; hyaline cell walls adjacent to the green cells finely papillose; outer surface of branch leaves with few or no pseudopores; stem leaves more or less triangular, apices blunt, scarcely auriculate, border not well-developed at base ..................... 8. *S. strictum*

7. *Sphagnum compactum* DC. *in* Lam. & DC., Fl. Franç. 2: 443. 1805.

Plants generally short, forming dense cushions, mostly with crowded fascicles that conceal the stem, sometimes taller with fascicles farther apart. Stem cortical cells in 2–3 layers, efibrillose, outer cortical cells aporose; stem leaves small, scarcely 1 mm long, concave, lingulate to oblong-triangular, auriculate at the base, bordered in the lower half, hyaline cells not divided. Branch cortical cells in one layer, efibrillose; branch leaves larger than the stem leaves, unranked, imbricate to squarrose, involute to concave but not roughened at back above; margins with resorption furrows; hyaline cells on the outer surface with few to many rather large, rounded pores near the commissures, often with numerous pseudopores, on inner surface usually with pores grouped in 3's at adjacent cell angles; in cross section green cells slightly elliptical, entirely included, with thin-walled connections between the inner and outer cell walls. Monoicous. Spores smooth to finely papillose, more or less 30 µm.

Illustrations. Crum & Anderson (1981), Fig. 7 A–L; Crum (1984), Fig. 9.

In small, compact cushions on periodically wet sand, siliceous rock, and moist or wet soil in open or sometimes shaded places. In Maine known from Hancock (*Redfearn 37752* DUKE, MO), Kennebec (*Allen 14772* DUKE, MO), Knox (*Dunham 7/1939* DUKE), Lincoln (*Allen 5973* MO), Oxford (Allen & Pursell *Maine Mosses 152* DUKE, MAINE, MO, NY, US), Piscataquis (*Hermann 19586* DUKE), and Washington (*Pedano 379* DUKE, MO) Counties.

*Sphagnum compactum* is best recognized by its compact habit, crowded fascicles, and mostly pale yellow-green to light-brown color. Only rarely is the species loosely branched. Infrequently plants of *S. compactum* can be tinged (but never entirely) pinkish red, and these pinkish plants can be confused with forms of *S. magellanicum* that have faintly fibrillose branch cortical cells. *Sphagnum compactum*, however, consistently differs from *S. magellanicum* in having branch leaves that at the apex are generally involute-concave, only very slightly cucullate, and never roughened on the back.

Although *S. compactum* and *S. strictum* are occasionally confused the two species differ in several branch leaf features. A good feature separating the two is found in the form and position of the green cells in cross section. Those of *S. strictum* are triangular and exposed more broadly on the outer surface, while those of *S. compactum* are elliptic and completely enclosed within the hyaline cells. Furthermore, in cross section the hyaline cell end walls adjacent to the green cells of *S. compactum* are entirely smooth, but in *S. strictum* they are usually finely papillose, although sometimes with only a few scattered papillae. In addition, *S. compactum* often has numerous pseudopores (i.e., small, pore-like structures encircled by fibril rings but not perforated) on the outer surface of the branch leaves, while those of *S. strictum* have few or no pseudopores.

8. *Sphagnum strictum* Sull., Musci Allegh. No. 201. 1845 [1846].
*S. humile* Schimp. *in* Sull., Mem. Amer. Acad. Arts, n. ser. 4: 175. 1849.
*S. garberi* Lesq. & James, Proc. Amer. Acad. Arts 14: 133. 1879.

Plants moderate-sized, mostly low and more or less densely branched, occasionally tall and loosely branched, yellow-green to occasionally reddish. Stem cortical cells in 1–3 layers, efibrillose, outer cortical cells aporose; stem leaves very small, less than 1.0 mm long, triangular with blunt, rounded apices, scarcely auriculate, border not well-developed at base. Branch cortical cells in one layer, efibrillose; branch leaves large, more than 2.5 mm long, ovate, sub-squarrose; margins with resorption furrows; hyaline cells on the outer surface with up to 6 non-ringed pores, with few or no pseudopores, on inner surface with 2–4 elliptic ringed pores, often in 2's or 3's at adjacent corners, hyaline cell side walls adjacent to the green cells minutely papillose with few or many papillae; in cross section green cells isosceles-triangular or trapezoidal, more broadly exposed on the outer surface. Sexuality uncertain. Spores coarsely papillose, more or less 36 µm.

Illustrations. Crum & Anderson (1981), Fig. 7 M–S; Crum (1984), Fig. 10.

In coastal cedar swamp. In Maine known from Hancock (*Faxon 6/25/1891* MO, NY) and Washington (*Crum 9/1991* DUKE, MO) Counties.

*Sphagnum strictum* is apparently uncommon in Maine. The presence of branch leaves with a resorption furrow distinguishes *S. strictum* from all Maine species of *Sphagnum* except members of *Sphagnum* section *Sphagnum*, *S. molle*, and *S. compactum*. Members of *Sphagnum* section *Sphagnum* differ from *S. strictum* in having fibrillose stem and branch cortical cells and branch leaves roughened on back near the apex; *S. molle* differs in having branch leaf green cells in cross section more broadly exposed on the inner surface. In contrast the stem and branch cortical cells of *S. strictum* are efibrillose, the branch leaves are not roughened on back near the apex, and the green cells in cross section are more broadly exposed on the outer surface.

*Sphagnum strictum* and *S. compactum* are the only members of section *Rigida* in Maine. The species can be distinguished by examining branch leaf cross sections. In *S. compactum* the hyaline cell end walls adjacent to the green cells are smooth and the elliptical green cells are completely included. In contrast *S. strictum* has papillose hyaline cell end walls adjacent to triangular green cells that are exposed more broadly on the outer surface. Furthermore, *S. compactum* has numerous pseudopores on the outer surface of the branch leaves, while those of *S. strictum* have few or no pseudopores.

3. *Sphagnum* section *Squarrosum* (Russ.) Schimp., Syn. Musc. Eur. (ed. 2) 835. 1876.

Plants moderate-sized to robust with a conspicuous terminal bud. Stem cortical cells in 2–4 layers, efibrillose, enlarged, thin-walled, usually without pores, sometimes with a single pore or pseudopore at the upper end; stem leaves more or less flat, ovate to ovate-lingulate, with broad somewhat perforated or fringed apices; margins scantly border above and below, hyaline cells not divided. Branch cortical cells in 1–2 layers, efibrillose, of two kinds, some enlarged with retort-like upper pores, others smaller and without pores; branch leaves spreading or strongly squarrose at least when dry; hyaline cells with large, rounded to somewhat elliptic pores on both surfaces; in cross section green cells triangular or trapezoidal, more exposed on the outer surface, hyaline cell end walls adjacent to the green cells nearly always with few to many very fine papillae.

1. Branch leaves abruptly narrowed from an ovate-hastate, erect base; conspicuously wide-spreading to squarrose above; stem leaves shorter (½–¾) than the branch leaves; branch leaf hyaline cells with ringed pores on the inner surface and non-ringed pores on the outer surface ... ........................................................................... 9. *S. squarrosum*

1. Branch leaves gradually tapering from an ovate base; imbricate or somewhat spreading at the tips; stem leaves as long or longer than the branch leaves; branch leaf hyaline cells with non-ringed pores on both surfaces ........................................................................................ 10. *S. teres*

9. *Sphagnum squarrosum* Crome, Samml. Deut. Laubm. 24. 1803.

Plants tall, robust, stiff, in bright, pale-green to yellow-green carpets; terminal bud large. Stem cortical cells in 2–3 layers, without fibrils or pores; stem leaves large, 1.5 to 2 mm long, more or less 1 mm wide, oblong-lingulate with broad, rounded apices, scarcely bordered; hyaline cells mostly resorbed on both surfaces. Branch cortical cells in 1–2 layers; branches long and tapering; branch leaves conspicuously wide-spreading or squarrose from an ovate-hastate, erect base, abruptly narrowed to an involute-concave, spreading acumen, toothed across the narrow tip, 2.0–2.8 mm long; hyaline cells convex on both surfaces, on the outer surface toward the apex with 1–3 round to round-elliptic, non-ringed pores at the ends and corners, at the middle and below with 10 or more large pores in 1–2 rows, on the inner surface with 4–7 large ringed pores at ends and along commissures; in cross section green cells triangular to trapezoidal, more broadly exposed on the outer surface, hyaline cell end walls adjacent to the green cells often lightly papillose. Monoicous. Spores smooth or finely papillose, more or less 25 µm.

Illustrations. Crum & Anderson (1981), Fig. 8 A–F; Crum (1984), Fig. 12.

Found in wooded, boggy areas, especially swampy coniferous woodlands, roadside ditches lined with *Thuja* and Hemlock, stream margins, fens, and calcareous as well as non-calcareous habitats. In Maine known from Androscoggin (*Allen 21765* DUKE, MO), Aroostook (*Allen 16300* DUKE, MO), Cumberland (Norton 72 DUKE), Franklin (*Allen 22616* DUKE, MO), Hancock (Rand 9/3/1892 MO, NY), Lincoln (*Allen 20021* DUKE, MO), Oxford (*Allen 21030* DUKE, MO), Penobscot (*Vreeland 10/18/1905* NY), Piscataquis (*Hermann 19136* DUKE), Somerset (*Allen 21536* DUKE, MO), Washington (*Holmes 156* MO), and York (*Allen 23061* DUKE, MO) Counties.

*Sphagnum squarrosum* is a common species in Maine that is usually easy to recognize in the field by its robust habit and strongly spreading or squarrose branch leaf tips. Slender plants of *S. squarrosum* with less-spreading branch leaves than normal can be confused with *S. teres* whose branch leaves can also be somewhat wide-spreading at the tips. In *S. squarrosum* the stem leaves are considerably smaller than the branch leaves which are generally more than 2 mm long and abruptly narrowed to the acumen, while the stem leaves of *S. teres* are as long or longer than the branch leaves which are usually less than 1.5 mm long and gradually narrowed to the acumen. In addition, the pores of the hyaline cells toward the base of the branch leaves of *S. teres* are much larger (more like leaf gaps) than those of *S. squarrosum.*

10. *Sphagnum teres* (Schimp.) Ångstr. *in* Hartman., Handb. Skand. Fl. (ed. 8) 417. 1861.
    *Sphagnum squarrosum* Crome var. *teres* Schimp., Vers. Entw.-Gesch. Torfm. 64. 1858.

Plants slender to moderate-sized in yellowish or brownish, loose to dense cushions; terminal bud large. Stem cortical cells in 3–4 layers, without fibrils or pores, although sometimes with a single large pore or pseudopore (membrane thinning) in each outer cell; stem leaves more or less flat, as large or larger than branch leaves, elliptic to lingulate-spatulate, somewhat fringed around a broad rounded apex. Branch cortical cells in 1 layer; branch leaves, erect, ovate-lanceolate, gradually narrowed to an involute-concave (at time spreading) acumen, toothed across the narrow tip, 1.0–1.5 mm long; hyaline cells on the outer surface with 4–8 large, elliptic, non-ringed pores near the commissures, on the inner surface with 1–4 irregularly rounded, non-ringed pores; in cross section green cells triangular to trapezoidal, more broadly exposed on the outer surface, hyaline cell end walls adjacent to the green cells minutely papillose. Dioicous. Spores essentially smooth, more or less 25 µm.

Illustrations. Crum & Anderson (1981), Fig. 8 G–L; Crum (1984), Fig. 13; Daniels & Eddy (1985), Fig. 35.

In red maple swamps and floating mats in ponds. In Maine known from Aroostook (*Spaulding 120* DUKE, MO), Kennebec (*Andrus 7203* DUKE, NY), Oxford (*Lowe 9/9/1942* DUKE), and Piscataquis (*Crane 596* DUKE, MO) Counties.

*Sphagnum teres* is rare in Maine and it is said to be a calciphile, growing as a pioneer in bog mats (Crum 1984) and in rich, weakly acid to slightly basic mires (Andrus 1980); also in red maple swamps, beaver meadows, and rarely in floating mats around pond margins. It is a northern species and should be more common in Maine than the present number of Maine collections indicates. Dried specimens of *S. teres* can sometimes be difficult to distinguish from *S. squarrosum* because in that condition its leaves tend to be somewhat squarrose at the tips. *Sphagnum squarrosum*, however, is generally somewhat larger than *S. teres*, and its branch leaves are usually abruptly narrowed and strongly squarrose above an erect base. Furthermore, the stem leaves of *S. squarrosum* are considerably smaller than its branch leaves (in *S. teres* the stem leaves are as long or longer than the branch leaves) and the branch leaf hyaline cells have ringed pores on the inner surface. The hyaline cells in *S. teres* are non-ringed.

The presence of single, large, well-developed pores or pseudopores on the stem cortical cells in some populations of *S. teres* combined with its apically fringed stem leaves and large terminal bud can cause confusion with *S. girgensohnii* Russ. The two species can be distinguished by examining branch leaf cross sections: in *S. girgensohnii* the green cells have greater exposure on the inner surface; in *S. teres* the greater exposure is on the outer surface.

4. Section *Isocladus* (Lindb.) Braithw., Sphagnac. Eur. 30. 1878.
   *Isocladus* Lindb., Öfvers. Förh. Kongl. Svenska Vetensk..-Akad. 19: 133. 1862.

Section *Isocladus* has only a single species, *Sphagnum macrophyllum* Brid., that consists of two varieties, var. *macrophyllum* and var. *floridanum* Aust. The var. *macrophyllum* occurs in Newfoundland and throughout the Nova Scotian peninsula, but skips to Long Island, New York and then continues in the Gulf and Atlantic Coastal Plain to Texas and southern Arkansas with disjunctions to the Cumberland Plateau of Tennessee and Georgia. It has not been reported from Maine. We have treated it here because Maine is in the interrupted portion of its range, and so could be found there, although the intervening coast line of New England between Long Island and Nova Scotia probably has been collected as thoroughly as any area in the United States. The var. *floridanum* is more southern, ranging in the Coastal and Gulf Plain from New Jersey to Florida, and not apt to be found in Maine.

*Sphagnum macrophyllum* Brid. var. *macrophyllum*, Bryol. Univ. 1: 10. 1826.
   *Isocladus macrophyllus* (Brid.) Lindb., Öfvers. Förh. Kongl. Svenska Vetensk..-Akad. 19: 134. 1862.
   *Sphagnum georgianum* Schwein. *ex* Sull., Mem. Amer. Acad. Arts n. ser. 4: 174. 1849.
   *Sphagnum macrophyllum* var. *burinense* Maass, Bryologist 70: 181. 1967.

Plants usually coarse and robust, deep-green, normally floating, submerged or temporarily stranded. Stem cortical cells 2–3 layered, without pores or fibrils; stem leaves small, less than 1 mm long, broadly triangular, rounded at the apex, scarcely bordered at base; hyaline cells not or rarely divided, without fibrils, on the outer surface without pores, on the inner surface with 1 large central pore and several round to elliptic pores, usually in a row. Branches in fascicles of 2–3 with little or no difference between spreading and pendent branches; cortical cells without pores or fibrils, rarely with an obscure apical pore, but not retort-like; branch leaves usually very long, 4–7 mm long, increasing in length toward the end of the branches, crowded in tufts, lanceolate, ovate-lanceolate to lanceolate-ligulate, apices acute to acuminate, stiffly tubulose when dry; hyaline cells long-linear, scarcely wider than the green cells, sinuose, without fibrils, on the outer surface with a single, median row of 5–12, more or less elliptic pores, inner surface without pores; green cells in cross section I-shaped, exposed about equally on both surfaces, lumens narrowly elliptic. Dioicous. Spores smooth to finely papillose, more or less 30 µm.

Illustrations: Crum & Anderson (1981), Fig. 9 A–F; Crum (1984), Fig. 14 a–l.

Usually completely aquatic, growing submerged or floating along the margins of fresh water, acidic lakes, ponds and permanent shallow pools. Like *Fontinalis*, it can withstand fluctuating water levels that leaves it stranded for periods of time. Not known from Maine.

*Sphagnum macrophyllum* is such an unusual *Sphagnum* species that it was at one time placed in a separate genus. The very long leaves and growth habit of *S. macrophyllum* make the species somewhat similar to *Fontinalis*, but similarity stops there. The branch leaf hyaline cells of *S. macrophyllum* are exceedingly long and narrow, not much wider than the green cells, they lack fibrils and have a single, median row of 5–12, evenly spaced, round to elliptic pores that extend from tip to tip. No other *Sphagnum* species in North America has this morphology.

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# Additions to the lichen flora of North America X. *Buellia arborea*

**Tor Tønsberg[1] and Bruce McCune[2]**

Abstract. Buellia arborea *is reported as new to North America from Montana, U.S.A.*

*Buellia arborea* Coppins & Tønsberg has a sorediate thallus and is usually sterile. The soralia are discrete, rounded to ellipsoid, flat to crateriform, and often distinctly bluish; the species contains atranorin and placodiolic acid (see Tønsberg 1992 for more details). It can easily be mistaken in the field for *Buellia griseovirens* (which however contains norstictic acid) and *Xylographa vitiligo* (stictic acid). It is lignicolous on hard and smooth (not decayed) wood in mostly open situation; more rarely it is corticolous. It is widely distributed in Europe, being known from Scotland and Norway (Tønsberg 1992), Sweden (Foucard & Nordin 1999), and the Alps (see e.g. Hafellner & Türk 2001). In Scandinavia it shows continental tendencies in its distribution (Tønsberg 1992), although it often occurs in locally humid sites (Foucard & Nordin 1999).

*Buellia arborea* was recently collected in Montana, U.S.A., by the second author. It grew on the hard and smooth wood of an old log on talus of siliceous metal-rich argillite above a river and in a W-facing slope in steep-walled valley. The material is sterile, but otherwise well-developed. Atranorin and placodiolic acid was confirmed by TLC. The species is here reported as new to North America. With the specimen cited below *Buellia arborea* shows a Europe to western North America disjunct distribution.

Specimen seen: U.S.A., Montana, Sanders Co., above Clark Fork river, near Lolo National Forest Boundary, E side of river, 47°20.5'N, 114°46.7'W, elev. 840 m, April 2001, *B. McCune 26023* with *J. Ponzetti & R. Rosentreter* (OSC); det. *T. Tønsberg 2001.*

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Hafellner, J. & R. Türk. 2001. Die lichenisierte Pilze Österreichs - eine Checkliste der bisher nachgewiesenen Arten mit Verbreitungskarten. Stapfia 76: 3 - 167.

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# New, rare, and interesting lichen taxa collected on the 2000 ABLS, Field Trip "Oregon Steppe to the Coast"; led by Dr. Bruce McCune. Aug. 10-13, 2000

**List compiled by: Roger Rosentreter**

Abstract: *Thirty three lichen or lichen parasymbiont species are reported as new, rare, and interesting from the group of ABLS members on this four day field trip in Oregon. Roselliniella nephromatis (Crouan) Matzer & Hafellner is new to North America. Contributors to a list of species collected on the trip were: Othmar Breuss, William R. Buck, Robert S. Egan, Elisabeth Lay, Bruce McCune, Matt Nelsen, Judy Robertson, Roger Rosentreter, Constance S. Stubbs, and Susan Will-Wolf. This large number of rare or interesting species illustrates that a group with different backgrounds and trained eyes are better than one set of eyes.*

**Oregon. Wasco Co.:** Mt. Hood Natl. Forest, Wapanita Pass, montane *Abies-Tsuga* forest, elevation 1200 m, 45°13.5'N, 121°42'W, 10 Aug 2000

*Absconditella lignicola* Vezda & Pisut -- Breuss 17.143. Not reported previously from the Pacific Northwest.

*Amygdalaria pelobotryon* (Wahlenb.) Norman -- Rosentreter 14118. Probably the southernmost record. (known from coastal BC -- see paper by Brodo)

*Cetraria subalpina* Imshaug – Lay 00-0375, Robertson 4723, Rosentreter 14,114. Grows on the base of shrubs in high snow accumulation areas, the species is uncommon in Oregon but is more abundant farther north in Canada.

*Hypogymnias* Nine species were present at this site! These are not rare species but it is of interest to illustrate the great biodiversity of this genus in the moist forests of the Pacific Northwest. The nine species present were: *Hypogymnia apinnata* Goward & McCune, *H. enteromorpha* (Ach.) Nyl., H. *imshaugii* Krog, *H. inactiva* (Krog) Ohlsson, *H. metaphysodes* (Asah.) Rass., *H. occidentalis* L. Pike, *H. physodes* (L.) Nyl., *H. rugosa* (G. Merr.) L. Pike, *H. tubulosa* (Schaerer) Hav.

*Pilophorus clavatus* Th. Fr. – This species of *Pilophorus* is less common than *Pilophorus acicularis* (Ach.) Th. Fr. and is very nice looking thus numerous collections were made of this saxicolous species which was common locally in the understory of the trees on numerous exposed granitic boulders. Breuss 17.179,17.190, Buck 37600, Egan 14,996, 14,992, Robertson 4732, Rosentreter 14111, Will-Wolf

*Rimularia limborina* Nyl. -- Breuss 17.202

**Oregon. Jefferson Co.:** Crooked River National Grassland, *Juniperus* and *Artemisia tridentata* grasslands, above Simtustus Reservoir on Deschutes River, basalt rimrock, 44°40'N, 12°114'W, 10 August 2000

*Buellia triseptata* A. Nordin -- Breuss 17.243, 17.245
*Rimularia insularis* (Nyl.) Rambold & Hertel – Breuss 17.225

**Oregon. Linn Co.:** Willamette Natl. Forest, near McKenzie River & Carmen Reservoir, old forested lava flow near covered with old growth conifer forest, elevation 810-920 m, 44°21'N, 12°200'W, 11 August 2000

*Brigantiaea praetermissa* Hafellner & St. Clair –on a large decayed log, Egan 15,070, Rosentreter 14129
*Dactylospora lobariella* (Nyl.) Haf. – Breuss 17.299
*Nephroma occultum* Wetmore – rare Pacific NW endemic (seen)
*Peltigera pacifica* Vitik. – Buck 37630
*Pseudocyphellaria rainierensis* Imshaug – rare Pacific NW endemic (seen)

**Oregon. Coos Co.:** Cape Arago to Sunset Bay, coastal conifer forest of *Picea sitchensis* and *Pinus contorta*, elevation 12 m, 43°20.8'N, 124°19.8'W, SW of Coos Bay, 12 August 2000

*Acrocordia cavata* (Ach.) R.C.Harris -- Breuss 17.405. Apparently not previously reported from Pacific Northwest. *Acrocordia gemmata* (Ach.) A. Massal. is reported from BC.
*Byssoloma leucoblepharum* (Nyl.) Vainio -- Breuss 17.411
*Byssoloma marginatum* (Arnold) Sérus. -- Buck 37722
*Hypotrachyna revoluta* (Flörke) Hale -- This species is infrequent to uncommon in the area --Egan 15,120
*Ionaspis lacustris* (With.) Lutzoni -- Rosentreter 14159. Reported from BC; a new report for Oregon, though other unreported sites are known from herbaria.
*Leptogium aquale* (Ach.) P.M. Jorg., Simpson Beach on sandstone – Rosentreter 14140
*Niebla cephalota* – This species is more common in southern California and Baja in Mexico, it was seen on this trip and was previously reported for Oregon by McCune, Rosentreter and DeBolt (1997).
*Peltigera pacifica* Vitik. – Will-Wolf
*Pyrenocollema halodytes* (Nyl.) R. C. Harris – grows on barnacles along the coast, -- Buck 37723

**Oregon. Coos Co.:** Oregon Dunes National Recreation Area, near Eel Creek Campground, broken *Pinus contorta* and *Arctostaphylous* sand dunes, within 2-4 km of the ocean, elevation 10 m, 43°31'N, 124°16'W, 13 August 2000

*Anaptychia setifera* Räsänen -- Rare in the Pacific NW occurs only along the immediate coast, Breuss 17.434, Lay 00-0347, Rosentreter 14148, Nelsen, Will-Wolf, Robertson 4804

*Bryoria pseudocapillaris* Brodo & D. Hawksw. –rare Pacific NW endemic of the immediate coast, Breuss 17.439, Buck 37734, Rosentreter 14155, Robertson 4806

*Bryoria spiralifera* Brodo & D. Hawksw. –rare species for this area and the farthest north known location, McCune 25497, 25498, Rosentreter 14152

*Cladina portentosa* (Duf.) Follmann ssp. *pacifica* (Ahti) Ahti –coastal species, Breuss 17.462, Egan 15,125, Lay 00-0350, McCune 25500, Nelsen, Robertson 4809, Stubbs

*Cladonia artuata* Hammer –recently described species, Breuss 17.465

*Peltigera hymenina* (Ach.) Delise -- McCune 25124

*Erioderma sorediatum* D. J. Galloway & P.M. Jørg – Tropical species that is rare in Oregon, Buck 37740, Egan 15,157, Robertson 4812

*Leioderma sorediatum* D. J. Galloway & P.M. Jørg --Tropical species that is rare in Oregon, Breuss 17.433, Buck 37738, McCune 25509, Robertson 4813, Rosentreter 14157

*Loxosporopsis corallifera* Brodo, Henssen & Imshaug –Locally common but endemic to the Pacific NW coast, Breuss 17.431, Buck 37751, Robertson 4794, Will-Wolf

*Roselliniella nephromatis* (Crouan) Matzer & Hafellner (on *Nephroma laevigatum* Ach. - New to North America) -- Buck 37735

*Sulcaria badia* Brodo & D. Hawksw. -- Rare endemic Pacific Northwest species that occurs in along the coast and the inland low elevation valley of Benton Co. On the world red-list of lichens, Buck 37755, Will-Wolf , Robertson 4814, Rosentreter 14149

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# The Synonymy of the African Moss Genus *Quathlamba* with the American genus *Neosharpiella.*

**Harold Robinson[1], Bruce Allen[2] and Robert E. Magill[2]**

The moss genus *Neosharpiella* was originally described by Robinson and Delgadillo (1973) and typified on the basis of a new species from alpine habitats in the mountains of central Mexico, *N. aztecorum* H. Rob. & Delgad. A second species was included from the Andes, *N. turgida* (Mitt.) H. Rob. & Delgad., that was originally described as a *Physcomitrium.* Among the distinctive features of this acrocarpous genus were its imbricated leaves that had blunt tips with distinctive 1– or 2–celled apices, and broadly oval to spherical capsules. Though not mentioned at the time, no attempt was made to place the genus in any other family than the Funariaceae in which the South American species had been originally described.

Recently, the senior author saw in the *Mosses of Southern Africa* (Magill 1987) the description of *Quathlamba* Magill, a new genus found at high elevations in alpine habitats in Lesotho. Despite the presence of a number of unusual gametophytic and sporophytic features, the genus had been placed in the Bartramiaceae because of its small mouthed, globose capsules, large warty spores, and stomata with two guard cells. The features of *Quathlamba*, however, including its thin, undifferentiated stem cortical cells, erect-appressed, ovate to elliptical or oblong-elliptical, nearly ecostate leaves, distinctive leaf areolation, and eperistomate, spherical capsules were those of *Neosharpiella.* Robert Magill and Bruce Allen at the Missouri Botanical Garden both made comparisons of the specimens and concluded that *Quathlamba debilicostata* Magill was not only a *Neosharpiella,* but that it was conspecific with an American species. As mentioned in the original description, African material has a spherical capsule with a small mouth and thin-walled exothecial cells that would most closely relate it to the Mexican species, *Neosharpiella aztecorum* rather than the Andean *N. turgida.* In addition, this synonymy is further confirmed by their axillary hairs: in *Quathlamba debilicostata* and *Neosharpiella aztecorum* the axillary hairs are three-celled (Fig. 1 E, F) while in *N. turgidum* they are two-celled (Fig. 1 I).

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*Neosharpiella aztecorum* H. Rob. & Delgad., Bryologist 76: 537. 1973.
Type: **Mexico**. Tlaxcala: N-facing slope of La Malinche, alpine, open, moist, soil, 11 Sep 1968, *Delgadillo 2599a* (holotype US; isotype MEXU).
*Quathlamba debilicostata* Magill, Fl. Southern Africa, Part 1 (fasc. 2): 421. 1987. Type: **Lesotho**. Top of Sani Pass, on soil of rock crevices along northern cliff face just E of Mountain Lodge, 2860 m, *Magill 4512* (holotype MO; isotype PRE), *syn. nov.*

The familial disposition of *Neosharpiella* remains uncertain. Placement of the genus within the Funariaceae is not acceptable due to its perennial habit, small, non-inflated calyptrae, and most importantly the presence of stomata with two guard cells. Mature stomates that often have a single cell with a central pore are a distinctive feature of the Funariaceae (Sack and Paolillo 1983; Robinson 1997) and have been considered one of the strongest unifying features of the family (see Fife 1985; Allen & Pursell 1991).

As noted above, African material of *Neosharpiella* was placed in the Bartramiaceae on the basis of its capsule shape, spore size and ornamentation, and 2–celled stomata. Otherwise, there is no particular reason for such a placement. Indeed, its odd gametophytic features, such as weak to nearly absent costae, smooth leaf cells, and undifferentiated stem cortical cells all argue against putting the genus in the Bartramiaceae. There have recently been two morphological studies (Griffin & Buck 1989; Virtanen 2000) of the Bartramiaceae that included *Neosharpiella* (as *Quathlamba*). The former considered *Neosharpiella* sporophytically close to *Bartramidula*. This in combination with its three-celled axillary hairs and similarity to *Philonotis* species with obtuse leaves, weak costae, and smooth leaf cells led them to keep the genus in the Bartramiaceae. Virtanen (2000) found that in some analyses *Neosharpiella* was associated with a group of Bartramiaceae taxa with reduced peristomes (*Bartramidula* among others), and although she maintained *Neosharpiella* in the Bartramiaceae, its relationships within the family remained unresolved.

Fife (1980) examined *Neosharpiella* in a study that related the genus to the Gigaspermaceae rather than the Funariaceae. In his view *Neosharpiella* belonged in the Gigaspermaceae because of its weakly developed to nearly absent costae,

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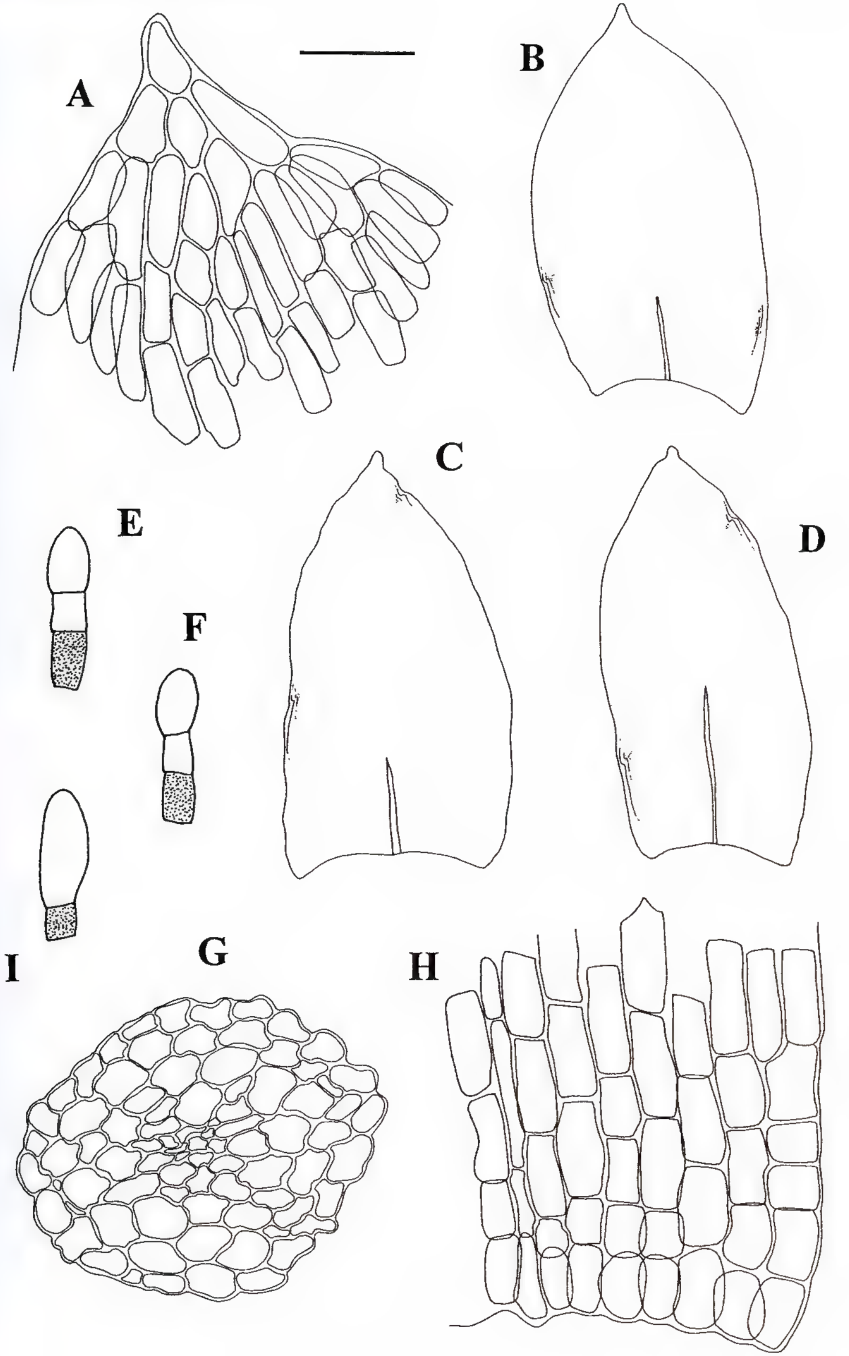
Figure 1. *Neosharpiella aztecorum*. A. Leaf apex. B–D. Leaves. E. Axillary hair (African material). F. Axillary hair (Neotropical material). G. Stem cross-section. H. Basal leaf cells and basal margin. *Neosharpiella turgida*. I. Axillary hair. Scale bar in mm: bar = 0.03 (E, F, I); bar = 0.06 (A, G, H); bar = 0.2 (B–D). Figures A–E, H from *Magill 7154a* (MO); figure F from Cárdenas 4118 (MO); figure G from *Magill 4512* (MO); figure I from *Lewis 87363* (MO).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ovate to elliptical or oblong-elliptical leaves (Fig. 1 B–D), enlarged, oblong leaf cells (Fig. 1 A, H), non-inflated, cucullate calyptrae, spongy, strongly wrinkled capsules, and large, coarsely verrucate spores. Most importantly Fife found that although *Neosharpiella* had extremely fragile stems that made dissection difficult, there were some collections that had whitish rhizomes.

Our examination of *Neosharpiella* indicates that Fife was correct in putting the genus in the Gigaspermaceae. In two collections (*Cárdenas 4118* and *Crosby 13547* both MO) short, white, rhizomatous stems appeared to be present. Most collections of *Neosharpiella* we examined had extremely fragile stems that broke apart on dissection. In these collections rhizomatous stems could not be demonstrated. The stems in these collections did have a dense covering of whitish rhizoids, and in this respect were identical to the stems of *Chamaebryum pottioides* Thér. & Dix. (*Magill 1981* MO), *Costesia spongiosa* Thér. (*Mahu 11361* MO), and *Gigaspermum repens* (Hook.) Lindb. (*Weber & McVean 33156* (MO). In addition to the features noted above by Fife that support the placement of *Neosharpiella* in the Gigaspermaceae we would add two other features. The undifferentiated stem cortex of *Neosharpiella* (Fig. 1 G) is a perfect match for those found in the Gigaspermaceae, and its capsule shape is matched by those of *Chamaebryum* and *Costesia*. Still, in view of the very weak rhizomatous stems in *Neosharpiella* its placement in the Gigaspermaceae should be considered tentative until material can be collected for sequencing.

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# The genus *Seligeria* (Musci: Seligeriaceae) in Maine

**Bruce Allen**

The Seligeriaceae are small to very small, acrocarpous mosses with an odd haplolepideous peristome. Their 16 peristome teeth are relatively broad at base, mostly reduced in length, considerably more thickened on the outer (dorsal) than the inner (ventral) surface and inserted within the capsule mouth. Edwards (1979) described the seligerioid peristome as having a very reduced **2:3** haplolepideous peristomial pattern, a thin membrane that adheres to the margins of the teeth and a prostome at the base of the teeth. He interpreted both the thin membrane and the prostome as an exostome. Most species of *Seligeria* Bruch & Schimp. *in* B.S.G. have such reduced peristomes that they are not useful in understanding the seligerioid peristome. For example, an examination of the peristomes of *S. brevifolia* (Lindb.) Lindb., *S. campylopoda* Kindb. *in* Macoun, *S. pusilla* (Hedw.) Bruch & Schimp. *in* B.S.G., *S. recurvata* Bruch & Schimp. *in* B.S.G., and *S. tristichoides* Kindb. found that only a **2:2** peristomial pattern was present, and neither a marginal membrane nor a basal prostome was present. In *S. acutifolia* Lindb. *in* Hartm. and *S. polaris* Bergg., however, an occasional **2:3** peristomial pattern and a marginal membrane were seen, but still no basal prostome was evident. *Seligeria polaris* has by far the best developed peristome of all *Seligeria* species. Its teeth are exceptionally well formed with very strongly projecting dorsal (outer) trabeculae and a remarkably distinct marginal membrane. This membrane is thin, hyaline, and appears to represent only primary cell walls. Most of the membrane consists of **PPL** wall remnants, but in several places **OPL** wall remnants are also present.

Edwards (1979) drew special attention to the seligerioid peristome, as did Vitt (1984) in erecting the suborder Seligeriineae. This, however, seems to be a too heavy emphasis on the odd features of this peristome. The relative thickness of the cell wall remnants in a peristome is one factor that determines the strength and direction of its motion on wetting or drying. Different patterns of hygroscopic motion presumably affect the timing of spore dispersal (Shaw & Robinson 1984). A peristome more heavily thickened on the outer rather than the inner surface may be associated with a pattern of spore dispersal that has adaptive significance. This type of peristome thickening appears to have arisen independently in a number of groups. Likewise, the marginal membrane found in the seligerioid peristome is also found in a somewhat similar state in *Dicranoweisia* Lindb. *ex* Milde (Allen 2000). As noted above these structures represent primary rather than secondary depositions. They appear to be the result

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of a simple failure of the outer tangential and radial walls of the **PPL** and the inner tangential and radial walls of the **OPL** to disintegrate as usually happens in a haplolepideous peristome. The seligerioid peristome is neither an elaboration of the haplolepideous peristome nor a vestigial diplolepideous structure, but rather as stated by Crum (1994) "... is not so much unique as aberrant."

The gametophytes in the Seligeriaceae are also unusual because their leaves lack internal costal differentiation. This distinctive feature occurs sporadically throughout the haplolepideous mosses, and is found in the closely related Dicranaceae (*Arctoa* Bruch & Schimp. *in* B.S.G.). In fact, all of the unusual gametophytic and sporophytic features of the Seligeriaceae occur in the Dicranaceae; however, the combination of a seligerioid peristome and homogeneous internal costal cells sets the group apart. Whether the group should be recognized as a distinct family or placed within the Dicranaceae (Dixon 1932, Holmen 1960) is questionable. Recognition of the group at the suborder level is unwarranted.

There are three genera in the Seligeriaceae, *Brachydontium* Fürn., *Blindia* Bruch & Schimp. *in* B.S.G., and *Seligeria*. *Brachydontium* has not been collected in Maine, although *B. trichodes* (Web.) Milde does occur in New Hampshire (Crum & Anderson 1981). *Dicranoweisia* has been placed in the family because of its similar pattern of peristomial thickening (Ochyra 1993). However, the genus has heterogeneous internal costal elements and so is better placed in the Dicranaceae (see Reimers 1936, Van Zanten 1971).

*Seligeria* Bruch & Schimp. *in* B.S.G., Bryol. Eur. 2: 7 (fasc. 33–36). 1846.

Plants small to very small, erect, usually sparsely branched, gregarious to tufted. Leaves lanceolate to linear or subulate from an ovate base, apices acute to obuse, erect when dry, erect-spreading to spreading when wet; margins entire to denticulate, costae strong, subpercurrent to excurrent, often filling the subulae; cells smooth, upper cells quadrate to short-rectangular, basal cells rhomboidal, rectangular or linear, alar cells usually not strongly differentiated. Autoicous. Setae straight, curved, or cygneous. Capsules erect, subcylindric, subglobose, or obovoid, often with a short neck, smooth to lightly furrowed when dry; stomata

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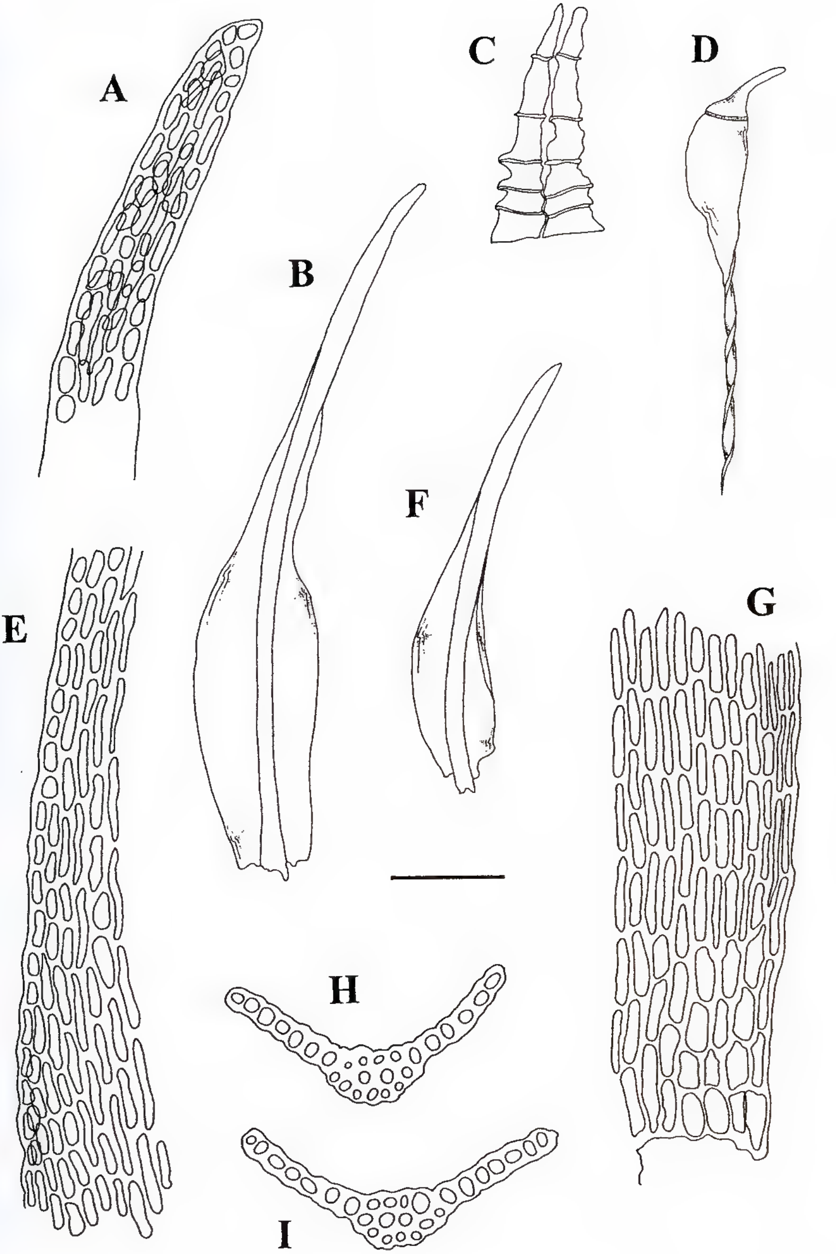
Figure 1. *Seligeria recurvata*. A. Leaf apex. B. Perichaetial leaf. C. Two peristome teeth, dosal (outer) surface. D. Capsule and operculum. E. Median leaf cells and margin. F. Vegetative leaf. G. Basal leaf cells and margin. H. Leaf cross-section above midleaf. I. Leaf cross-section below midleaf. Scale bar in mm: bar = 0.05 (A,C,E,G–I); bar = 0.2 (B,F); bar = 0.5 (D). All figures from *Collins 3085* (NEBC).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in neck; opercula obliquely rostrate; annuli simple; peristome teeth 16, inserted within the capsule mouth, narrowly triangular, smooth or rarely papillose roughened. Spores spherical. Calyptrae cucullate, smooth, naked.

Although *Seligeria* has two species endemic to New Zealand (see Vitt & Bartlett 1983), its remaining 19 species are confined to the Northern Hemisphere. Many *Seligeria* species have a circumboreal distribution. The genus is restricted to calcareous substrates, and this in combination with its small size may be why it is so rare in Maine. Since *Seligeria* is autoicous it commonly has sporophytes and this helps in recognizing it in the field. Important features of the *Seligeria* leaf include its weakly differentiated alar cells and costae that in cross-section have only stereid cells.

*Brachydontium* like *Seligeria* is an autoicous genus, but it occurs on acidic rocks and further differs in having striate capsules, a complex annulus, and mitrate calyptrae. *Blindia* is a dioicous genus of relatively robust plants that typically occur on wet, acidic rocks. At first glance *Blindia* appears adequately distinct from *Seligeria* due to its larger size and well-developed alar cells, but the genera have similar peristomes and costae made up of homogeneous cells. Furthermore, *Seligeria* and *Blindia* are closely linked by subgenus *Blindiadelphus* Lindb., a group of species sometimes placed in *Seligeria* (Vitt 1976) and other times referred to *Blindia* (Hagen 1910, Steere 1953). Like *Blindia* the members of subgenus *Blindiadelphus* are large, often branched plants with differentiated alar cells and a blackish-brown coloration, but like *Seligeria* they are autoicous calciphiles. Species in subgenus *Blindiadelphus* also have the best developed peristomes of any species in the family and in this regard they more closely resemble *Blindia* than *Seligeria.*

*Seligeria* was named for Ignaz Seliger (1752–1812) a clergyman and student of Silesian cryptogams (Stafleu & Cowen 1985).

*Seligeria recurvata* (Hedw.) Bruch & Schimp. *in* B.S.G., Bryol. Eur. 2: 12 (fasc. 33–36). 1846.
*Grimmia recurvata* Hedw., Sp. Musc. Frond. 75. 1801.

Stems small, erect, 0.5–2 mm high, central strand present. Leaves erect to erect-flexuose or somewhat incurved when dry, erect-spreading when wet, lower leaves lanceolate, upper leaves subulate from an ovate-lanceolate base, 1–1.5 mm long, apex setaceous; margins entire or serrulate at the shoulders, erect or slightly incurved; costae single, filling most of the subula, excurrent, in cross section only stereid cells present; cells smooth and incrassate throughout, upper cells subquadrate to short rectangular, 10–18 x 4–8 μm, basal cells elongate, 14–48 x 3–6 μm, alar regions with subquadrate or rectangular cells. Setae 2–4 mm long, straight or flexuose when dry, straight to curved-cygneous when wet, yellow when young, becoming reddish-brown. Capsules 0.5–0.8 mm long, obovoid, smooth or lightly furrowed when dry; stomata in neck; opercula oblique-rostrate, 0.3–0.6 mm long; annuli rudimentary; peristome teeth narrowly triangular, entire, dark-red or red-brown, smooth, dorsal (outer) surface thick, inserted within the capsule mouth. Spores 7–12 µm, spherical, ovate, or oblong, faintly papillose. Calyptrae cucullate, smooth, naked, 1–1.5 mm long. $n = 13, 14$ (Fritsch 1991).

On rocks. In Maine known from Somerset (*Collins 3085* NEBC) County.

*Seligeria recurvata* is known in Maine from a single collection made by J.[ames] Franklin Collins (b. 29 December 1863; d. 14 November 1940) at Moxie Falls sometime around 1900. Moxie Falls is an area with unusual rock types, and in 1990 I found a number of mosses there that commonly occur on calcareous substrates. *Blindia acuta* is also very common at Moxie Falls, and it is interesting to note that *Collins 3085* contained some plants of *Blindia acuta* as well as *Seligeria recurvata*.

One important clue for recognizing *Seligeria recurvata* in Maine is its association with calcareous substrates. In addition, despite its very small size the common occurrence of sporophytes calls attention to the species in the field. Under the microscope the presence of leaves with smooth cells, weakly differentiated alar regions, and costae that lack internal differentiation and mostly fill the subulae are important features of the species. Sporophytically, its often cygneous setae, and short, smooth peristome teeth that are considerably thicker on the outer (dorsal) surface than the inner (ventral) surface add distinction to the species.

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# Colorado Bryological Hot Spots

William A. Weber & Ronald C. Wittmann

During our preparation of a revision of the guide to the bryophytes of Colorado (Weber 1973), current intensive field work has revealed a much more diverse flora than we had imagined fifty years ago. The revision is badly needed because at the present time there is no single volume that covers all of our bryophytes. So little has been published about them that we want to describe for amateur bryologists a few of the richest areas. We begin this series with the Boulder Mountain Park, a reserve of the City of Boulder, situated at 40 degrees North Latitude.

The Park is a photographer's dream and its trails and vistas attract thousands of visitors, joggers, and dog walkers. It protects raptorial birds by prohibiting climbing during the nesting season, and has guides and schedules many field trips and interpretive programs. Collecting of plants and animals is forbidden except by permit. Rock climbing is extremely popular; there are hundreds of routes, and as a result parts of the area have been badly trampled. The Park receives more visitors in a season than does Rocky Mountain National Park! Nevertheless, The citizens of the City of Boulder have exercised great foresight in preserving their Park and open spaces, and continue to acquire lands which still contain relatively unspoiled portions of the ecosystem.

The Continental Divide reaches its easternmost limit in North America in Boulder County; the gradient from the plains (5,000 feet) to the high peaks (13-14,000 feet) is very steep and short. It is dissected by canyons with mossy north exposures, and the alpine tundra is within a half-hour drive. The Boulder Mountain Park represents the eastern anchor of this altitudinal segment.

A jagged group of steep rock walls of arkosic conglomerate (Fountain Formation) of Pennsylvanian age forms a striking backdrop on the west edge of Boulder. Behind these "Flatirons" Green, Bear, and South Boulder Peaks rise to 8,500 feet altitude, formed of the granite bedrock characteristic of the Rocky Mountain Front Range. The Dakota Ridge, at the east base of the Flatirons is a cuesta of vertical outcrops that parallel the Rocky Mountains from here to Montana. The Boulder Mountain Park includes outwash fans with residual tall grass prairie, a varied series of rock formations including shales and sandstones, and the Flatirons lie against Precambrian granites. The vegetation varies from grassland to riparian canyon-bottoms with *Acer*

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*glabrum* and *Corylus cornuta*, *Prunus-Crataegus-Rhus trilobata-Cercocarpus* thickets, *Pinus ponderosa* and *Pseudotsuga* forests, and numerous steep north-facing canyon sides favorable for bryophyte development.

A few miles east of the city, along Boulder Creek, a spectacular exposure of south-facing sandstone cliffs, the "White Rocks", is also a reserve although not a part of Boulder Mountain Park and harbors a limited but interesting desert-steppe bryophyte flora, including *Grimmia plagiopodia*, on its curious surface "turtleback" formations, a small colony of the rare fern, *Asplenium adiantum-nigrum,* and a few hepatics including at one time our only station in Colorado for *Phaeoceros laevis*, in the Laramie Sandstone.

For plant geography, the most interesting feature of the Boulder Mountain Park is a meteorological phenomenon— a frequently occurring cloud veil that hangs along the Flatirons and provides a local humid atmosphere. Here, on a day when this occurs, one may walk up into the gulches and be drenched although no rain may fall. The vascular flora is especially rich here (see Hogan 1993, Weber & Wittmann 2001), and recently our attention to this feature was dramatically fueled by the discovery of several disjunct moss species. The known populations of these mosses are very small, but they cannot be said to be rare, because much of the region, steep and difficult of access, has not been explored.

Professional botanists frequently learn that it takes a rank novice to make crucial discoveries, partly because the professional claims to know which areas are most fruitful, and the novice does not. This year we recruited Gary Mazurek, whose main interest is in Tardigrades. We met quite accidentally getting off the local city bus. Gary overheard me speaking to the bus driver about our work, introduced himself and said that he would like to learn some mosses because they are habitats for Tardigrades. I immediately drew Gary into our small circle and showed that I could identify his mosses, and if he learned to recognize them, he could make a real contribution to tardigrade geography in the Rocky Mountains, where very little has been published. While Tardigrade specialists usually have to seek out experts for identification of the lichen and moss habitats long after the collections are made, Gary will be able to sample the same moss species from different sites and establish some important ecological-geographical data.

Gary lives within walking distance of the Flatirons. The next day he went up to the Mesa Trail which runs along them from north to south, and brought back a garbage bagful of paper sacks of mosses. I identified them for him, and he returned to the area, bringing back another batch, mostly the same common species. This time he wanted to show me a moss that was quite new to him. It was *Rhytidiadelphus triquetrus,* new to Colorado and disjunct from Montana, California, and Arkansas.

The following day we joined him to see the extent of the population, and found an area ten feet square, where *Rhytidialdelphus* was intermixed with *Pleurozium schreberi,* another disjunct known previously in Colorado from a small area in Rocky Mountain National Park.! Each subsequent visit has netted novelties, the latest being *Neckera complanata* and *Entodon cladorrhizans*! I plead guilty for not, in fifty-five years of botanizing in Colorado, thoroughly explored the Flatirons area. However, the horse is never content to graze in his own pasture.

Another bryological hot spot is the notch or saddle between Green Mountain and Flagstaff Mountain (a popular picnic area and overlook). The south-facing slope is a combination of fixed granite outcrops and great boulders. On the steep slope there is seasonal seepage over the rocks. The only common moss on this site is *Bryum alpinum,* which forms beautiful golden-brown or golden-green polsters easily visible from the car window. The north-facing slope is at the north end of Gregory Canyon, where a trail begins at Baseline Road in Boulder and is easily followed up to the summit of Green Mountain. It is difficult to reach the seeping cliffs, for the trail diverges from the main drainage and access is made either by scrambling down the talus or by beating ones way through very dense stands of *Salix irrorata,* which in the past half century have become almost impenetrable.

The seeping north-facing ledge has a remarkable assemblage of bryophytes and chasmophytic vascular plants, notably the Front Range endemic, *Selaginella weatherbiana.* Here we find, besides the usual common components, *Anacolia menziesii, Bartramia ithyphylla, Brachythecium acuminatum, B. velutinum, Bryum gemmiparum, Campyliadelphus chrysophyllus, Didymodon tectorum* (see Zander 2001), and *Homalothecium nevadense.*

Several trails lead to the summit of Green Mountain. Long Canyon is particularly interesting because it supports the only population of paper birch (*Betula papyrifera*) in Colorado. The colony is greatly affected by introgressive hybridization with the dark-barked *B. fontinalis* (see Froiland 1952), and only a few trees have the typical white, peeling bark; most of the intermediates are in a cluster at the upper end of the canyon, and have bark resembling *Betula lutea.* In a side canyon there is a small population of the rare orchid, *Malaxis monophyllos* and *Botrypus virginianus.* The cool north-facing canyons support many Pleistocene relictual vascular plants of the midwestern woodlands, including *Sanicula marilandica, Aralia nudicaulis, Carex sprengelii, Bromopsis pubescens,* and *Cylactis pubescens* (Weber 1965).

## BRYOPHYTES OF BOULDER MOUNTAIN PARK MOSSES

Abietinella abietina, COLO 49085
Amblystegium riparium 111357
Amblystegium serpens 111356
Amphidium lapponicum 49082
Anacolia menziesii 111351
Atrichum undulatum 112032
Aulacomnium androgynum 110671
Bartramia ithyphylla 111352
Brachythecium acuminatum 112049
Brachythecium collinum 17596
Brachythecium erythrorrhizon 110673
Brachythecium fendleri 11008
Brachythecium rivulare 111497
Brachythecium velutinum 111354
Bryoerythrophyllum recurvirostrum 111359
Bryum alpinum 111364
Bryum amblyodon 111353
Bryum argenteum 49094
Bryum caespiticium 112139
Bryum flaccidum 112029
Bryum gemmiparum 111393
Campyliadelphus chrysophyllus 112134
Campylophyllum sommerfeltii 35450
Ceratodon purpureus 112052
Coscinodon calyptratus 113385
Dicranoweisia crispula 18237
Dicranum montanum 111481
Dicranum rhabdocarpum 18392
Dicranum tauricum 14918
Didymodon tectorum 10580
Didymodon vinealis 49101
Encalypta vulgaris 49099
Entodon cladorrhizans 112178
Fabronia ciliaris 19010
Fontinalis neomexicana 112024
Funaria hygrometrica 106963
Grimmia anomala 112124
Grimmia elatior 49075
Grimmia longirostris
(specimens on loan)
Grimmia “montana group” 49084
Grimmia pulvinata 12183
Hedwigia ciliata 23044
Homalothecium nevadense 49072
Hygroamblystegium tenax 111358
Hypnum cupressiforme 111362
Hypnum revolutum 49087
Hypnum vaucheri 49091
Leptobryum pyriforme 20925
Leptodictyum riparium 111357
Leptopterigynandrum austroalpinum 112205
Lescuraea incurvata 11496
Mnium arizonicum 2000
Mnium blyttii 110678
Neckera complanata 112176
Neckera pennata 112177
Orthotrichum alpestre 9657
Orthotrichum anomalum 30133
Orthotrichum hallii 112051
Orthotrichum laevigatum 49092
Orthotrichum rupestre 49078
Paraleucobryum longifolium 112205
Philonotis fontana 112133
Plagiomnium cuspidatum 16934
Plagiomnium medium 11010
Plagiothecium laetum 112123
Pleurozium schreberi 112026
Pohlia cruda 111495
Pohlia nutans 106964
Pohlia wahlenbergii 49076
Polytrichum juniperinum 14649
Polytrichum piliferum 14679
Pseudoleskea nervosa 49098
Pseudoleskeella nervosa 112031
Pseudoleskeella sibirica 112135
Pseudoleskeella tectorum 24571
Pterigynandrum filiforme 112050
Pylaisiella polyantha 112048
Rhynchostegium pulchellum 111361
Rhytidiadelphus triquetrus 112026
Sanionia uncinata 110682
Schistidium confertum 19615
Schistidium pulchrum 110683
Syntrichia intermedia 112179
Syntrichia norvegica 112138
Syntrichia ruralis 27014
Syntrichia sinensis 112027
Timmia austriaca 26826
Timmia megapolitana 3624
Tortella tortuosa 112137

Tortula mucronifolia 112028
Weissia controversa 49100

HEPATICAE

Athalamia hyalina 25756
Cephaloziella divaricata 110674
Cephaloziella rubella 49097
Lophozia barbata 110677
Lophozia hatcheri 11007
Marchantia polymorpha 26960
Porella cordaeana 111363
Preissia quadrata 24508
Radula complanata 24793

Total 98 species

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## Correction

### An improved miniprep method of DNA extraction for bryophytes

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The mailing address for Kelsi Scott was missing from the paper.

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## Guide to contributors to *EVANSIA*

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